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Informational Hearing on Kesterson Reservoir

Assembly Committee on Water, Parks and Wildlife

California Legislature

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Sacramento, California

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JIM COSTA
CHAIRMAN

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CHAIRMAN JIM COSTA: Our first witness this afternoon is the Executive Director of the State Water Resources Board. Mr. Easton, Will you please identify yourself for the record. As I stated at the outset, what we're really interested in is finding out the process under which the hearings will take place next week and what the expected follow through will be vis a vis timelines and such as we look at the order that was implemented over a year ago. That was Order 87-3, which prescribed a certain remedy to close Kesterson and required the cooperation of the United States Bureau of Reclamation. Many of us testified before the state board at that time as to our concerns about the appropriate means for closure. We expressed concerns not only for the environment but also about the economic costs. At that time, I went on record as supporting the board's decision. I still maintain that position, but I do believe with new information that has come to light over the last year and a half since the Bureau has attempted to comply with that order, it is appropriate that we review that information. My concern is the means under which we can get the same results in closing Kesterson environmentally, maybe improve upon those results, and do it in a fashion that's cheaper. There may be several of these facilities throughout the Southwest that may require closure as well, and there are concerns that this process that the state board has established could set the precedent for closure. Some of the cost figures I've seen are at the level of approximately $100 million or more, associated with the current decision, and if that is to be the case we potentially could have a lot of

funds tied up in these types of closures. So, we're very interested in the state board's current process and the following witnesses will indicate to us whatever information they've put together over the last year and a half.

With that said, Mr. Jones, do you have any comments? Would you please proceed, Mr. Easton?

MR. JIM EASTON: Chairman Costa and Mr. Jones, I'm Jim Easton, the Executive Director of the State Water Resources Control Board. I bring you greetings from the state board, and I'm glad that you understand why it would be difficult or impossible for them to testify before you today because of the proximity of their hearing, which will be held next week.

CHAIRMAN COSTA: We understand that. You might want to speak directly into the microphone. You'll be heard a little bit better.

MR. EASTON: What I'd like to do, very briefly, is outline some history that's gone on and then go through the process, as you've suggested, that the state board will be going through next week and perhaps next month in dealing with Kesterson Reservoir. As you know, this all started back in 1984 with the Claus petition to the Region 5 board. That subsequently, through a series of events, wound up in the state board issuing Order 85-1 in February 5, 1985, ordering the Bureau to come forward with a closure plan. Evidentiary hearings were held by the state board on January 26 and 27 of last year on that closure plan. During that hearing the Bureau presented several alternatives for closing Kesterson Reservoir permanently, and on

March 19, the board, in Order 87-3 ordered the Bureau to proceed with the on-site disposal option. The implementation of that order was turned over to the Central Valley regional board, and it consequently issued waste discharge requirements for Kesterson Reservoir and an August 1988 deadline was established for the completion of the on-site disposal work at Kesterson Reservoir.

In March of this year, bids were received by the Bureau. During that same month we began to get copies of letters from Congressmen Bevel and Miers indicating some congressional concern with what was going on with Kesterson and recommending that the Bureau not proceed with the award of the contract for the on-site disposal. In late March, Secretary Hodel advised us that the award was to be made. On April 15 of this year, we got a letter from Mr. David Houston of the Bureau formally requesting that the board reopen the matter and reconsider its previous order on Kesterson. As a result of that, we have hearings scheduled for May 24 and 25, next week, at which time new evidence will be received by the board and at which time the board will reconsider its earlier order.

Now the board has a couple of options it can take as a result of this evidentiary hearing. It can choose to do nothing, in which case its earlier order will stand and the earlier deadline will stand. It can reaffirm that order, in which case the order and the deadline will stand, or it can change the order based on the testimony that's received during the hearings next week. We have tentatively scheduled dates in June for a board workshop and a board meeting in order to adopt a new order if

that's necessary and if the board chooses to do that, and in essence, that's the process that's going to be gone through next week by the board.

CHAIRMAN COSTA: So, the evidence will be submitted next week during the two day hearing, and then you will follow in June with a workshop with the board to go over the evidence submitted next week, is that correct?

MR. EASTON: Yes, that is correct, if the board chooses to amend its order. If the board does not choose to amend its order, it can do nothing and the order will stand.

CHAIRMAN COSTA: At the quickest possible juncture, and you'll have to excuse me, I'm not familiar with the common fashion in which these matters are handled by the board, if the board decided to let the order stand as is, could that happen as quickly as the end of the second day of the hearing?

MR. EASTON: I wouldn't think so because the Bureau has submitted in advance, at our request, substantial evidence...

CHAIRMAN COSTA: Yes, we've received copies of it and it is substantial. It is, as they say, bigger than a bread box.

MR. EASTON: Yes, it is, and we're going to need...

CHAIRMAN COSTA: You'd need a wagon to carry it.

MR. EASTON: ...some time to review that plus whatever verbal testimony is received at the hearings, and I would think that it's going to require probably a couple of weeks for the staff to go through that testimony and to make a recommendation to the board. Now, we anticipate that if we go to workshop it will be on the 7th of June. That's about as fast as we can do it.

CHAIRMAN COSTA: Is there public participation allowed at the workshop? Or, is it just staff and the board members?

MR. EASTON: What will happen is that the board staff will make a recommendation to the board which it will present at the workshop. Hopefully we would have it out a few days before that so that the parties could review it, but at the workshop the board will make no decision but will, again, welcome testimony from anyone who's interested in the staff recommendation.

CHAIRMAN COSTA: I see. As far as the testimony that you take next week, is that going to be available for anyone who wants to participate?

MR. EASTON: Yes.

CHAIRMAN COSTA: Okay, so there will be two public forums under which information testimony will be taken?

MR. EASTON: That's correct.

CHAIRMAN COSTA: Next week, and then the workshop in June?

MR. EASTON: June 7. Now, the only reason there wouldn't be a second public forum is if the board concludes that there is no need for one. If they conclude that the earlier order is still adequate and not to amend the order, then there would be no workshop and no board meeting in June.

CHAIRMAN COSTA: And, on these types of matters, is there any sort of track record based upon..., and I know Kesterson is somewhat unique in terms of how the board has dealt with it and the attention that has surrounded it, but is it common to go with a workshop when you have these type of issues?

MR. EASTON: Yes. If a different decision is going to be made. Now, if Order 87-3 is to be complied with, I think all that would be necessary then is a letter from Chairman Maughan to Mr. Houston indicating that the state board wishes him to proceed on the basis of the earlier order.

CHAIRMAN COSTA: And in that case, there wouldn't be a workshop?

MR. EASTON: There would not be a workshop in that case. Or, there could be, if the chairman wants one he can have one anyway.

CHAIRMAN COSTA: I understand. If there's a workshop and further information is taken, then what's the timeline from that point?

MR. EASTON: I think June 23 we've scheduled the board meeting, again, we will want to consider whatever testimony is received at the June 27 workshop before we submit a final order for board action on the 23rd of June.

CHAIRMAN COSTA: All right, so if the board decides that they want to review this matter and consider some of the other options that you outlined to us, then we would know what the board's decision is by as early as June 23?

MR. EASTON: That's right.

CHAIRMAN COSTA: Mr. Jones, do you have a comment or a question?

ASSEMBLYMAN BILL JONES: It's my understanding that the topics of the hearing next week would not just focus on the suggestions made by the department, but also on the..., or would

the board, I should say, look at the new information on the original decision that was not available to them when they originally made the decision for on-site proposal?

MR. EASTON: One of the main purposes of the hearing is to hear any new information, new evidence, that may be available or may have become available since the original decision was made.

ASSEMBLYMAN JONES: On the original decision plus on any alternatives that might have been suggested?

MR. EASTON: Yes. Perhaps, Mr. Jones, it would be enlightening if I read the key issues that were in the hearing notice. The key issues were: What new evidence is available regarding the adequacy of the on-site disposal plan reviewed by the state board in Order 87-3; second is, can the United States Bureau of Reclamation demonstrate that an alternative to on-site disposal affords equivalent protection against water quality impairment; third, what new evidence is available regarding alternative clean up plans for Kesterson Reservoir; and, fourth, should state board Order 87-3 be modified? Those are the four basic things that will be considered by the board.

CHAIRMAN COSTA: Thank you very much, Mr. Easton. We appreciate your comments in terms of the process. I think that made it clear, and I know you have some other things you have to do, but Mr. Kanouse has indicated he will stick around to answer any other technical questions we may have.

MR. EASTON: Okay, thank you.

CHAIRMAN COSTA: Thank you.

Our next witness is Mr. David Houston, the Regional Director of the United States Bureau of Reclamation. Mr. Houston, we appreciate your information. I see you brought the same information with you today that was provided earlier to my office.

MR. DAVID HOUSTON: We wanted to have that available, Mr. Chairman. If anyone else did need it, we would certainly try to made it available to them.

CHAIRMAN COSTA: I've been trying to sleep on it, and it makes interesting reading material.

MR. HOUSTON: It's a little heavy, but it is interesting reading, bedtime reading I would suggest.

CHAIRMAN COSTA: As I indicated at the outset, Mr. Houston, many of us, both in the audience, yourself, and the members here today, participated in the decisions on Kesterson in 1985 and throughout the history of this matter. I am on record as supporting Order 87-3 for a number of reasons. At the time it seemed like, with the information at hand, the best way to go environmentally. Although I was not excited about the cost factors, it was my understanding that the federal government, since they had the responsibility of creating the holding pond facility, would provide the funding for closure.

My question to you, as you make your summary statement to the members of the committee is, has any new information transpired over the last year since 87-3 has been issued. Is there a means under which we can environmentally close Kesterson in a more efficient manner that will protect wildlife and public

health and safety? If there is a better way to do it, is that way better economically? Is it less costly? A number of the congressmen that were mentioned earlier, Mr. Bevel and some of the others, were very concerned not only about the potential cost, $100 million plus that they might have to provide for closure, but they indicated to me and Mr. Jones and others that they thought this might establish a precedent for other situations in which they had federal facilities that would require closure in the same fashion. So, they're not only looking at the potential costs for Kesterson, but application of that in other parts of the Southwest. My question to you is, very simply, is with the new information that comes to hand, is there a way in which we can economically and environmentally get the same results in a fashion that's less costly?

MR. HOUSTON: We believe, Mr. Chairman, there is. For the record, my name is David Houston and I currently serve as the Regional Director for the Bureau of Reclamation and obviously, Mr. Chairman, I'm here today at the committee's request to try to express our views on the clean up of Kesterson.

What I'd like to do if I might is spend just a few moments outlining the pre-hearing submittal we've made to the state board. I do have a copy here, and as you'll note, it's about 2700 pages. Rather than present all of that, I would like to at least highlight a number of things that are there and perhaps spend just a few moments walking through a statement with the committee and then try and return, if we might, to any particular portions you or other members of the committee might have.

CHAIRMAN COSTA: Please, go ahead.

MR. HOUSTON: Let me begin by saying that we certainly do appreciate an opportunity to participate with this committee and others in California to discuss the drainage issues, not only as it relates to Kesterson but elsewhere in the San Joaquin Valley. I'm hopeful that our participation, and particularly the summary of the research findings that we have, as it relates to Kesterson Reservoir, will assist this committee in any actions or activities it plans to take with respect to drainage issues in the San Joaquin Valley.

I think one thing that needs to be emphasized, and I'd like to state it, is the notion that the department is committed, and has been committed, to cleaning up Kesterson Reservoir and taking care of the environmental problems there. We have never really had a question within the department of whether we have an obligation. I think rather our efforts and our energies have been focused on developing an environmentally sensitive and cost effective strategy which protects public health and the environmental values in the Kesterson area.

The state board, in its order March 19, 1987, directed the Bureau to proceed with the on-site disposal plan, we frequently refer to that as ODP, which really consisted of developing a containment facility where we could place the vegetation and contamination soils from the surface of Kesterson Reservoir and hold those for a period of time. In April of the same year, on April 7, the Secretary announced that the department would comply voluntarily with the board's order.

Despite our disagreement with the board concerning the best clean up approach, we've taken all of the necessary steps to meet that commitment. We have proceeded very diligently and in good faith to achieve the board's order and acting in the context of that order. First of all, we received, after our request, a supplemental appropriation in 1987, a budget amendment in fiscal year 1988. As you're aware, we did complete the designs and specifications of the containment facility, put those out to bid, and consistent with encouragement from the board, we've continued our research efforts at Kesterson and have broadly shared our findings of the research results.

Recently, as you mentioned, Mr. Chairman, the congressional appropriations subcommittees, and that's both of our subcommittees for appropriations, the Energy and Water Development Subcommittee, which has jurisdiction over the Bureau, and the Interior and Related Agencies Subcommittee, which has jurisdiction over the rest of Interior, sent letters to the Secretary questioning the efficacy and the cost of the clean up approach, which was approved by the board, and they encouraged us to approach the board and request their reconsideration of that order. The letters created an obstacle for us, that without assurance of continued funding necessary to do the post-excavation management activities, which we estimate range in the neighborhood of from $13 to $100 million depending on which ones are actually successful, it appears that the environmental problems as Kesterson could be worse rather than cured by going with the on-site disposal strategy that we had initially outlined and the board had adopted.

While preparing for the on-site excavation and disposal activities, in accordance with the board's order, we did continue our research effort at the reservoir for two purposes; the first was for guiding or planning post-excavation management, and second, furthering our limited understanding of the geochemical and biological properties and behavior of selenium under various environmental conditions. The significant finding of this research was that excavation pursuant to the approved on-site disposal plan will not, and I emphasize not, in and of itself achieve a satisfactory level of environmental protection at Kesterson. Because a significant fraction of the residual selenium, that is the selenium that would remain after excavation, still exists in pore waters in the vadose zone, basically in the dry area beneath ground surface, and the water table, we have selenium in those unsaturated areas that are forced to the surface with rising water levels.

CHAIRMAN COSTA: The water level is pretty high in that area. How many feet are you talking about?

MR. HOUSTON: We have fluctuations within the area of the near surface ground water, but the selenium in the vadose zone goes as deep as 10 feet or more where the concentrations would exceed the clean up objectives that we've all adopted for Kesterson Reservoir, and that is the 5 parts per billion level, the goal that we've adopted in the initial clean up plan. The values that we end up seeing in the vadose zone range from hundreds, and some cases ten hundreds, and in a couple of places in the thousands. To actually excavate everything you would have

to excavate in the neighborhood of, in some areas, as much as 10 feet, whereas the on-site disposal plan contemplated excavation of only about the top 6 inches with isolated excavation elsewhere where the soil selenium residual exceeded a four part per million objective. One of the fundamental things we've learned is that, the 4 part per million objective is probably inappropriate, in light of continuing research that we've done in that area.

Related findings of the research also, with soluble selenium in the vadose zone does not pose a continuing substantial risk of further ground water contamination because the geochemical processes that immobilize selenium are present down there in the ground water system, so we don't see the selenium being mobile and moving to ground water. But that soluble selenium would rise with ground water as it rises in the area, towards the surface, and the values that we see in the ephemeral pools, as they are called, would be greater than or equal to that which was previously discharged when we were actually delivering drainage water to the reservoir.

Additionally, I would note that selenium concentrations in organisms, and that's the vegetation, the insects, the mosquito fish is an example, in these ephemeral pools, remain in the same range of values that we saw when drainage water was actually being delivered to the reservoir.

These findings are of special concern to us from the standpoint of wildlife protection, because the presence of water in the reservoir attracts a greater diversity of wildlife, and particularly water birds, and the quality of that water is

obviously critical to the health of the wildlife that is resident there. Excavation under the approved clean up plan cannot alone ensure protection of wildlife at Kesterson Reservoir because the existing plan does not address the concerns associated with the formation of ephemeral pools in Kesterson after excavation. In fact, the excavation as planned will increase the potential for formation of ephemeral pools in Kesterson by decreasing the distance between the ground surface and the water table. The formation of ephemeral pools in Kesterson can be minimized by a combination of appropriate actions: grading and filling are examples, but the essential issue for us is whether it's prudent to first excavate, and thereby increase the magnitude of subsequent actions in light of the expected cost of the sequence of these actions.

At this juncture, Mr. Chairman, I'd like to familiarize the committee briefly with some of our research findings with respect to the other strategies that we've added to our investigation and follow up that with a brief overview of what we have indeed recommended to the board, and I think that gets to the heart of the question that you presented; do we think there's a less expensive, more environmentally sensible solution, and indeed we do.

Wetflex, that's a term that we coined to describe a process that we previously presented to the state board as a component of the flexible response plan that we had encouraged the board to adopt. Conceptually, it entails keeping the ponds wet with selenium-free water and utilizing the natural properties

of selenium in the environment to maintain it in a form which is biologically unavailable. A test facility was constructed in Pond 5, we refer to that as Pond 5E, which has enabled us to do a number of experiments to validate whether the hypothesis was valid. The research has demonstrated that within six months the concentration of selenium in Pond 5E, the surface water, had dropped below the goal of five parts per billion and have remained low for the past 18 months. The rest of Pond 5, which continued to receive drainage water, or at least higher selenium water after Pond 5E was constructed, is showing similar results to Pond 5E but lags in its process by about a year.

By June of 1987, and that's one year after the water was introduced in Pond 5E which was selenium free, the base food chain items dropped from 50 to 60 parts per million to 5 to 10 parts per million. The concentrations rose last autumn but in January were about 10 to 20 parts per million. Similar patterns were observed for the invertebrates and the mosquito fish, one of the best examples is perhaps the damsel fly nymphs, which are common water bird food, where their concentrations dropped from 90 parts per million down to 16, in January back up around 29, but overall the decreases we've seen range from 46 to 94% in the eighteen months since we initiated those experiments. The autumn increases suggest that there's some kind of recycling through what we expect to be microbial processes in the bottom sediments.

Some of that selenium has actually volatilized to the atmosphere, that is, biologically unavailable. Some is taken up by some of the plants, the other food chain items. But the bulk

of it is recycled back into the sediments. The hypothesis that we have is that most of the selenium will return to the sediments within a period of time and be biologically unavailable. Early results for the experiments that we've initiated this year also are beginning to support that hypothesis, but I would emphasize to this committee in view of the continued uncertainty over whether controlled flooding can be used effectively for environmental protection at Kesterson, and as I'll discuss later, we are now proposing, basically, a dry management approach.

You've heard of the expression "microbial volatilization". It's received much attention lately. We've been conducting experiments on its applicability at Kesterson. Research suggests that volatilization can accelerate and permanently deplete the selenium in the Kesterson environment. Laboratory experiments suggest the potential for up to 50% depletion in four months, with no lower threshold for how effective it can be. That is, it is not critical and if it gets down to one part per billion range it continues to work, so conceptually, at least, it could go to zero.

Field experiments were initiated last year and are still too preliminary to forecast absolute results, but the preliminary measurements show a fifty times increase, not 50% but a fifty times increase beyond background levels. These tests were initiated in October, and since volatilization is temperature dependent, results this spring and summer are expected to be higher.

There are uncertainties with the volatilization strategy, including the intensive management required, much like irrigated agriculture, air quality considerations, the requirement for a low salinity water supply, and the fact that, alone, it cannot address the ephemeral pool issue, but it does offer promise for permanently removing selenium from the site.

Our ground water research has also shed light on the site characteristics at Kesterson. Selenium does not appear to be a major problem for ground water contamination because the selenium is immobilized near the surface where there are a limited number of exceptions where in the past high concentrations of nitrate appeared to have overwhelmed what they refer to as de-nitrifying bacteria in the high infiltration rate areas in the ponds. Over 70% of the monitoring wells which had elevated levels now show declines, and many are below the 10 part per billion level.

CHAIRMAN COSTA: On the selenium that you talk about that's immobilized near the surface, what level of parts per billion are we talking about, approximately?

MR. HOUSTON: In the ground water system we've actually seen concentrations, and I need to draw a distinction for the committee: in ground water concentrations there were examples in the seventies, eighties, perhaps a bit higher than that, actually, in the saturated zone, that is, in the water. You have a level above that where you have water in what is referred to as unsaturated zone, or pore water. The concentrations there have been as high as 4500 parts per billion. The area that I'm

addressing right here is the area in the ground water itself. What we have found is that, because of the reducing conditions there at Kesterson you don't find the selenium going deep into the ground water and migrating at very great distances. The natural properties down there tend to strip the selenium out, attach it to the soil and similar kinds of processes, so the selenium really doesn't go deep and it doesn't move very far, and that's controlled by natural processes.

The principal point there is that we don't see significant ground water contamination, nor would we expect ground water contamination to continue. In the past, the areas where the ground water was, indeed, contaminated, it appears to have been because of high nitrate levels in the drainage water. Nitrate has a source of oxygen in it; oxygen tends to oxidize the selenium; when the selenium is oxidized, it's highly mobile. In the absence of nitrate you no longer have that oxidizing presence there, and what we have seen under the research results is that in absence of the nitrate the selenium concentrations in the wandering wells are actually declining. There are only twelve wells where we still have concentrations above 10 parts per billion, and most of those are also showing a decline.

CHAIRMAN COSTA: I was just wondering how that compared with the ponds there..., we have some ponds that have been dried there at Kesterson today that you've used in your experimentation?

MR. HOUSTON: Yes, that is correct, Mr. Chairman.

CHAIRMAN COSTA: I'm just wondering how the levels there, how much that compared with, in the levels of the parts per billion, with other areas in the alluvial fans where we've determined there were selenium hot spots that are currently being cultivated.

MR. HOUSTON: Let me try to address that. What we were putting in in the form of an average concentration of drain waters selenium values, that is, when Kesterson was open and receiving drain water the concentrations were in the neighborhood of 360 to 400 parts per billion. The hot spot areas that you refer to, say, out of individual farm sumps, went as high as between 1000 and about 4800 parts per billion in isolated areas. What we have found beneath Kesterson are concentrations approaching 100, thereabouts, in some of the ground water areas, 70 and thereabouts, when we had nitrates going in a well. Those are in isolated areas within the reservoir. Pond 2 is an example, Pond 11 is another example. What we find in the wells now that no longer are we placing nitrogen in the ponds is that all of those monitoring wells are cleaning up, going to lower concentrations, where only a few are above 10 parts per billion now. So they've all shown substantial clean up. But I want to draw a distinction between the pore water that we see, and that's above the saturated zone of the soils. In that area we find them in the hundreds, the thousands, much as you expect in an off-site farm drainage system. But the operating properties between a farm drainage system and what we see at Kesterson are different. We are actively bringing the water out from an oxidized area, and

here what we have is a rising water table that fluctuates up and down.

CHAIRMAN COSTA: I understand that. Please go ahead.

Mr. Harvey, it's nice to have you here.

MR. HOUSTON: On the basis of this research, we've concluded that residual selenium at Kesterson can be effectively controlled in place without excavation. We're proposing a course of management actions to the state board for this purpose. An essential step in this course of action is to determine what may be the extent of the ephemeral pools formed by rising ground water in the reservoir under the circumstance where the influence of flooding of the reservoir on the underlying ground water has been eliminated. We would then act to eliminate, or at least effectively minimize, the residual formation of the ephemeral pools that are so attractive and dangerous to wildlife.

Contemporaneously, we would proceed to determine what combinations of the controlled volatilization and associated cropping, tilling, and other management actions can be most effective at permanently and safely dissipating selenium from the Kesterson Reservoir and minimizing the attractiveness of the dry habitat to wildlife. Scientific progress in our understanding of how selenium behaves in the environment and how to best manage it may have applicability throughout California and the west where selenium contamination problems exist, and that was one of the issues that the appropriations committees were, indeed, addressing.

By recommending this alternative course of action, we are by no means abandoning the basic goal of effective environmental protection at Kesterson Reservoir. Our view, however, is that it can achieve this goal at justifiable cost, through the course of action we've recommended to the state board. I think, Mr. Chairman, our view is that we can find a more effectiveness, more environmentally sensitive solution and we believe we have recommended that to the board in our pre-hearing submittal.

CHAIRMAN COSTA: So, to sum it up, you've gone from a preference about a year and a half ago that emphasized the wetflex method, to voluntarily complying with the board's order that would involve, for lack of a better term I'd call it the entombment process, to now what's referred to as a dry method, in essence, you're just drying up the ponds and preventing the vegetation from growing?

MR. HOUSTON: That is basically the strategy that we have underway, is to operate it dry. It's not attractive to waterfowl, that kind of wildlife, the shore birds and other things. Additionally, in our research, I might add, we found no evidence of harm to the upland habitat species. So we haven't found evidence. It appears the upland habitat is far safer for wildlife than is the wet areas. What the overall objective would be is to try to eliminate ephemeral pools, continue with a combination of volatilization, agricultural practices, tilling practices, to eliminate exposure, eliminate harmful effects to wildlife.

CHAIRMAN COSTA: And you would maintain it in a dry state in perpetuity?

MR. HOUSTON: That's basically what we would do, is get it dry. You don't need to address the in perpetuity issue if either of two things work: the volatilization, if it's as positive as the initial results would appear you would actually permanently deplete the site of selenium. In that case, restoration might be possible. So there are options...

CHAIRMAN COSTA: How many years are you talking about?

MR. HOUSTON: We've been very reluctant to give forecasts there, because you are working on basically what they refer to as sloping curve relationships. The question is how quickly will you get down low, how low will you ultimately get? The basic notion is to eliminate exposure to wildlife so that you don't have wildlife exposure. In the absence of wildlife exposure you have no human health exposure. We believe by eliminating the exposure you've basically taken care of the health and wildlife protection. Additionally, if through the volatilization experiments we can permanently dissipate the selenium into the atmosphere and relocate, basically, from the site or if we can operate with planting and harvesting, where you actually harvest selenium as it goes into the crops, if you can harvest the vegetation you can also remove selenium. It would not be the kind of notion where we've historically thought in perpetuity you would manage it a particular way.

CHAIRMAN COSTA: So, you've gone from a preferred wet method to a burial to now dry. What would be the cost of this preferred method?

MR. HOUSTON: The costs we laid out in the submittal we gave to the state board, the overall costs of the flexible, or this recommended plan which we've put before the state board, including the costs we've already invested, are about $37 million. I would note that that's on Page 15 of Volume 1. We do have extra copies of that for members of the committee here as well. With the on-site disposal plan, by comparison, we're looking at $48 million as the initial cost and up to, and I emphasize "up to," $96 million. It's possible, conceptually at least, that a combination of those would be in place, so it would be somewhat less than $145 million as the board had approved it, but that would be competitive, say, with the $37 million solution that we have currently recommended to the state board.

CHAIRMAN COSTA: So, you're saying that this method would be approximately $100 million less costly?

MR. HOUSTON: Essentially, that's what we're saying.

CHAIRMAN COSTA: Approximately. Questions by..., comments by the members of the committee?

Mr. Harvey, for a comment or question.

ASSEMBLYMAN TRICE HARVEY: I guess the comment is that when you're talking about volatilization and you've got into drying it out and not interfering with upstream habitats, could you explain that a little better. I understand when you dry out and you don't have the wildlife on there it's not going to get into the stream of food supplies to people and it's all contained, but beyond that, you were talking about upstream, was that the word you used? Or the upper part...? You're drying

everything out, and you've got water that's coming up there..., I didn't understand what you were saying. Everything was fine up above.

MR. HOUSTON: Okay. There is no more water going into Kesterson Reservoir, other than two sources: rain of course, which goes everywhere. We also have a rising ground water level beneath Kesterson. When we flood up all of the duck clubs which surround Kesterson, the water table seasonally rises. The basic objective is to try to eliminate the ephemeral pools where you don't have wetlands and wildlife exposure in that form. We would do other methodologies at Kesterson, the volatilization is an example, where you add organics such as citrus peels or manure, other things, which activate the microbes in the soil which tends to let the selenium go up into the air. So we try to manage selenium on site through that method. Additionally, we will be looking at planting various kinds of crops which are selenium accumulators, in the one instance, where you could take selenium up out of the soil and harvest the vegetation. The other instance may be using selenium rejectors to plant, where you basically have a cropping pattern there that has no selenium in it. The key issue for exposure appears to be, though, the wetland area, and even though the wetflex, as we called it, shows promising results for getting the levels down low, you continue to have some exposure there to the water birds in particular.

ASSEMBLYMAN HARVEY: Well, I guess the thing that threw me off, Mr. Chairman, I thought what I heard you say, referring to "here it is, we're going to dry it up, it didn't bother the

fowl and so forth above...", I thought you meant upstream or something. I didn't understand what you were referring to. You had a phraseology there that threw me off. Evidently I didn't understand what you were saying.

CHAIRMAN COSTA: All right. Is that clear now?

On Page 26 of the program budget summary, on Fiscal Year 88 for the on-site plan, you have proposed $21.9 million, that's for this year, is that correct?

Page 26, Mr. Houston. The Kesterson Program Budget Summary, Table 1, $21.9 million that's been appropriated, is that correct?

MR. HOUSTON: That's the amount of money we currently have available, that is currently.

CHAIRMAN COSTA: The excavation low bid, if I read it correctly last month, seemed like it was at $8.2 million, is that correct? Something around that figure?

MR. HOUSTON: That's correct.

CHAIRMAN COSTA: What is to become of the remainder of the money?

MR. HOUSTON: What we've seen in the appropriation mark up out of the house this year, we did ask for an additional, I believe the number is $13 million, in Fiscal Year 89 to be able to round out what the appropriations would be to complete the on-site. What the House Subcommittee did was take $3 million out of that and divert it to other programs, so they have not given us in the 89 budget as it is all of the money that we would have needed for the on-site.

CHAIRMAN COSTA: But in the 88 budget do you have the $21.9 million?

MR. HOUSTON: There is adequate money to do, that is, the on-site containment facility, the first round of scraping, there wouldn't be adequate money for the second round or for cleaning the sediments from San Luis Drain, or more importantly, the post-excavation management. One thing I need to make clear is that if we do the on-site, that is, if we scrape six inches or more in some areas, one thing we will do is increase the areas of ephemeral pools where there's rising groundwater, is a problem. One of the ways to eliminate the ephemeral pools is to fill in the low spots, that is, basically eliminate the water from every reaching the surface. By scraping out six inches of soil, what you basically have created is the obligation to bring in more fill, if indeed that is the strategy proposed excavation management. The other strategy proposed excavation management is to do the same thing that we're talking about now with a dryflex, if you will, that is, trying to dry it out, use the volatilization and cropping, discing, and other plans that we've outlined, the other strategies we've outlined, to minimize exposure.

CHAIRMAN COSTA: You're saying you're concerned that the ODP method would worsen the ephemeral pools, is that correct?

MR. HOUSTON: That is correct.

CHAIRMAN COSTA: Then, in your excavation, couldn't it be possible to localize your scraping so that in one area you could complete it under the ODP method as planned, and that would

lessen the amount of selenium to dilute, or to volitize? Is that possible? So that you could continue the research.

MR. HOUSTON: I guess the argument would be, yes, you could continue the research, but why would you spend the money in advance when the research that you are applying and the methodology you are applying is the same you would do without it? The one thing that you do create with on-site is a larger area of ephemeral pools. That is, you're excavating certain of the areas down there including some of the clays to put the liner beneath the on-site disposal facility, you are also scraping a good bit of the topsoil out of most of the areas, at least to six inches in some areas and maybe twelve inches in other areas, to achieve basically the 4 part per million goal we have in the soil. What you've basically done is increase the aerial extent of these ephemeral pools. If you were going to come back and fill those pools, basically what you've done is increase your cost. If the strategies are effective and we have eliminated wildlife exposure, why would you spend the money in the first instance, I guess, is the question. Do we think we can avoid the expenditure of the on-site by going with the same strategy we'd have to apply post-excavation.

CHAIRMAN COSTA: Okay. Any other questions or comments from members of the committee?

If you could stay on hand, there may be some other questions based upon comments that some of the other witnesses make that we might want to follow up on.

MR. HOUSTON: Okay, and if I do need to get away, I do have a couple of members of my staff: Susan Hoffman is here who is the project manager, Larry Hancock is my assistant regional director, both will also be available to respond to questions as well.

CHAIRMAN COSTA: You appear to have come well-equipped.

MR. HOUSTON: Thank you, Mr. Chairman. It was a pleasure to be here.

CHAIRMAN COSTA: Thank you for your time and your effort.

Mr. Jones?

ASSEMBLYMAN JONES: Since Mr. Harvey's here and he represents a good part of the southern San Joaquin Valley, and Senator Don Rogers, who is not here but represents a good part of the Tulare Lake Basin area, you mentioned at the close of your comments that the concern of some of the congressman was the potential for this kind of a problem being prevalent throughout the western states. Do you have any feel for, I know in California we have a rough idea, Tulare Lake area, even down in Imperial, and we see in passing some comments about Nevada and what have you. Do you have any idea how extensive and therefore how critical it is that we get a handle on the right way to approach this up front, dealing with naturally-occurring elements so that you folks will be able to deal with this most cost effectively and most effectively throughout your jurisdiction?

MR. HOUSTON: We have what we call an interagency drainage program under way, not only here in California but in

other states as well. We just completed a few weeks ago the Interior report on a number of the sites we had under investigation. With me here today is Dr. Johnathan Beason from the department who is the drainage coordinator. I will try and do a quick summary. If we want more detail, I know that John would be pleased to respond to any questions.

There are a number of sites where we have similar problems, or at least similar concentrations to what we have seen at Kesterson. As an example, in the Tulare Lake Basin, there are a number of areas down there where high concentrations have existed. Within the Stillwater Wildlife Management area, over in Nevada, basically an area east of Fallon, Nevada, we see cause for concern there. There are a couple of other sites in the west which we are conducting further investigations, much the way we have the drainage program here in California, which are of concern. The information that we're developing not only in our research at Kesterson but also in the San Joaquin Valley Drainage program where we've been investing $8 or $9 million a year at the Bureau looking for solutions, I think all of those have implications for us on a westwide basis. There are a number of areas where we are concerned. I think it has particular applicability elsewhere here in California.

ASSEMBLYMAN JONES: Okay, thank you, that's fine.

CHAIRMAN COSTA: One final question, Mr. Houston, you are obviously making the case for another solution to the board next week. In your view, based upon all the studies that you've been involved with, do you believe there's any advantage, given

the environmental downsides, toward allowing continued research for another year? In another six months or a year of tracking the decline of the selenium levels and some of the other aspects that deal with the volatilization process, could more information bring another alternative for closure?

MR. HOUSTON: When you're forecasting the future, you know, to quote a line we've heard, predictions are difficult whenever dealing with things, particularly the future. I think it was Dave Kennedy's quote in Bulletin 160 on that. I think whenever we're dealing with the kinds of research we are now it is very likely, and I would say most probable, that we will find new information which leads to additional solutions. We found a lot of new information over the past 18 months. We've learned a great deal about Kesterson in particular. Some of those things will likely have application elsewhere, and I say will likely. You can't always be certain because of the site conditions, site characteristics, and other things, but I think the things that we've learned, particularly on volatilization, immobilization strategies that we've used at Kesterson, we've learned a great deal on how to deal with selenium. I would expect, quite frankly, that over the next year we will continue to see things which will offer promise, but we think what we've done with the plan that we've just recommended to the board is that we can eliminate the wildlife exposure for all intents and purposes there at the site, operate through a combination of grading, filling, volatilization, and vegetation management to where we can, we think, correct the problem there. Each of those

strategies, I think, offer promise elsewhere in California and perhaps the West.

CHAIRMAN COSTA: What would be the environmental downside of continuing research for another year?

MR. HOUSTON: From our perspective while we have not eliminated at this point all of the environmental effects, they are substantially reduced from where they have been historically. Last year, as an example, the one measured effect on reproduction was the left eye of a bird was smaller than the right eye, as compared with the gross deformities we've seen historically at Kesterson. Obviously, that's encouraging. This year, right now, we're saying no use of Kesterson by tricolor blackbirds. They've moved to an alternative habitat that we've created. As I've mentioned, we've seen no evidence of impacts on upland game, that is, in the dry areas we don't see the kinds of effects that we see in the wet areas, and that's one of the principle reasons for moving towards the dry, as distinguished from the wet where we've been. So, from an environmental downside, I think you'll find within Interior, and that's both the Bureau of Reclamation and the Fish and Wildlife Service, there's full support for this kind of a management strategy because we don't see the exposure that we've historically seen.

CHAIRMAN COSTA: Is Fish and Wildlife here today?

MR. HOUSTON: They are not here today. They will be with us before the state board. Much of the testimony here that you'll see in our plan is Fish and Wildlife Service testimony.

CHAIRMAN COSTA: All right. Thank you very much.

Mr. HOUSTON: Thank you, Mr. Chairman and members.

CHAIRMAN COSTA: We appreciate your time and your efforts, and we hope that your staff will remain available in the event that there are further questions.

Our next witness that we have before us is a Mr. Steve Hall, Executive Director from the Land Preservation Association.

Mr. Hall, would you please proceed.

MR. STEPHEN HALL: Thank you, Mr. Chairman, and good afternoon, members.

My name, for the record, is Stephen Hall. I work for the Land Preservation Association. I have submitted written testimony. I should note, I suppose, that it is somewhat less voluminous than the Department of Interior's submittal.

As most of you know, Land Preservation Association is an organization composed of 12 water agencies that serve the west side of the San Joaquin Valley. It's both farmland and wetlands. We have a strong interest in the issue that's the subject of this hearing. Like everyone we want to see Kesterson Reservoir cleaned up. Beyond that, we're concerned about the influence that Kesterson Reservoir has on the entire drainage issue, because that drainage issue affects the land that we serve perhaps more than any other area of the state, both the farmland and wetlands. Unfortunately, Kesterson Reservoir has shaped public policy on the entire drainage issue. We say unfortunately, because in many cases the perception does not match the reality, but there is a strong image being created, and we want the lasting image that endures to be one of a problem that's had an effective solution.

Now, I'm not a scientist, and I'm not going to try to pose as one today, but if you'll permit a few observations from a layman about what has been learned at Kesterson Reservoir, I think it has been discovered that Kesterson Reservoir is not the environmental disaster that some have claimed. On the other hand, it is a pretty tricky environmental problem that does not lend itself very well to conventional solutions. And on-site disposal, the current plan in place is a conventional solution. It's a landfill. You may term it something else, but it's effectively a landfill. And scientists have discovered, over the past year or so, that landfills don't work very well in areas with high water tables, particularly where the water table carries with it some of the contaminates that you're trying to clean up.

In defense of those who proposed on-site disposal, both the state board and the Department of Interior, when that option was selected it was viewed as the most sure way to clean up the site. Since then, they've learned that it has some flaws that may be fatal. They've also learned a good deal about the other methods that could be used at Kesterson Reservoir to clean it up, methods that use the natural properties of selenium, so that you can actually use those natural properties to decontaminate the site. Among those, volatilization that you've already heard something about and you'll hear more about, appears to be the most promising.

Our position about how clean up should be carried out at Kesterson Reservoir is pretty simple. Since we're not a

scientific organization we've not attempted to analyze the voluminous data that's been generated, but we can say unequivocally we want the clean up to be carried out as soon as possible. Everybody wants that. But we also recognize there's just too much at stake to choose a method just because it happens to be expedient.

We believe the technical aspects of the clean up methods that are proposed are best judged by the scientist who conducted the research that's gone on and by the state board and its technical staff, but we also believe the plan should have the following elements as a minimum. Number one, that it be based on good science, and while there's lot that we don't know about Kesterson Reservoir there's certainly a good deal of information that has been developed. Number two, that it needs to have a specific timeline so that all parties of interest can be assured that at some point Kesterson Reservoir will be be cleaned up so that it is not a hazard to wildlife, to groundwater, or to public health.

CHAIRMAN COSTA: I think the timeline, Mr. Hall, is critical. One of the factors that I know went into my own decisionmaking process when I supported Order 87-3, which I thought there were some problems with but nonetheless was willing to go ahead with, was the need for a timeline. Order 87-3 had a timeline under which Kesterson could be closed and put behind us. My concerns on the public policy basis and the political concerns that are related to that public policy are that we have tremendous drainage problems throughout this state, a million and

a half to potentially two million acres in California out of the nine million acres that are irrigated in the next 15 to 20 years may have drainage-related problems. I think it's more important to get people to focus on correcting the drainage problems rather than using Kesterson as a kind of political football that can be used to kick around to create fears among the public as to the fact that we're not attempting to deal with this properly. I'm glad to see that you are concerned as well as to a timeline, that we do have a time certain to put Kesterson behind us.

MR. HALL: We couldn't agree more, and in fact, we're encouraged by the proposal to dry the reservoir site out, because I think it's clear that the number one priority has to be to eliminate, or at least to minimize, any impacts to the environment, and so to the extent that you can make the site environmentally benign, you've taken the first important step towards resolving the problem.

And that leads to our third point which is to assure that environmental impacts are minimized both during and after the clean up process. On that last point, LPA recently made a proposal that was based upon our concerns in terms of the effectiveness of on site disposal. The proposal essentially called for taking time to develop a clean up plan that would, in fact, meet the environmental goals that have been set and in the interim to develop wetlands in the immediate vicinity, to lure any waterfowl or other wildlife that was still present at Kesterson and being impacted away from the site so that there wouldn't be any impacts. Now, since we initially developed that

proposal the idea for drying of the reservoir site has been proposed, and that would add greatly to minimizing the risk at Kesterson. In addition, it's been suggested that rather than developing new wetlands, which may or may not be effective, by providing additional water supplies to existing wetlands, you can in effect get more bang for the buck by providing more habitat for less money.

At any rate, where we stand today is that the board will very soon make a decision about whether to proceed with on-site disposal or to choose some other method. If another method is chosen, it seems pretty clear that it's not going to be implemented right away and so I guess where we are is that we'd like to renew our proposal, renew our support for it, and suggest to anyone who's interested in working on it that we would be happy to work with them in developing the idea into one that's viable to minimize to the extent possible any environmental risk.

Just to close, we agree with you, Mr. Chairman, that Kesterson has taken the dominant role in the drainage issue, public policy is being shaped by it, and we believe it's been clearly shown that there just are not, there is not enough evidence to suggest that a conventional approach in this case is the best one, so we're supporting innovative approaches that make sense for this unique circumstance, that are not borrowed from some other technology or some other industry. That applies not only to Kesterson but to the drainage issue in total, and if technical evidence indicates that a better way is available, then we believe that should be adopted by the board and pursued, and

we are willing to work with others who are seeking constructive solutions on this issue and the entire drainage issue, not only for Kesterson but for the entire west side.

That concludes my remarks.

CHAIRMAN COSTA: Thank you very much, Mr. Hall, for being brief but to the point and concise.

Mr. Jones or Mr. Harvey, question or comment?

All right. A couple of quick ones. You obviously, in your statement, support closing Kesterson down as quickly as possible, sir, is that correct?

MR. HALL: That is correct. I think everyone does.

CHAIRMAN COSTA: And LPA is on record of supporting a means to deal with the drainage water problems on land internally as opposed to exporting that drainage water out of the valley, is that correct?

MR. HALL: It is correct that LPA does not see a short term export to other areas, and by short term I mean in the foreseeable future, the next couple of decades, and we are committed to solving the problem in the valley.

CHAIRMAN COSTA: I just wanted to raise that point. We had a piece of legislation earlier this week that would prevent the drainage water from being exported to the waters of the Pacific Ocean near Monterey Bay and such, and there have been other pieces of legislation that have tried to create the same effect in the Delta area, and my point, as I've tried to educate my colleagues, we don't intend to try to export that problem to them, that we need to deal with the problem internally and we're

working to that end. Unfortunately they don't necessarily take that at face value.

Thank you very much, Mr. Hall.

MR. HALL: Thank you.

CHAIRMAN COSTA: Our next witness that we have is Mr. Bill DuBois from the Farm Bureau Federation. Please proceed, Mr. DuBois.

MR. BILL DUBOIS: Thank you, Mr. Chairman. My name is William DuBois. I am Director of Natural Resources for the California Farm Bureau Federation. We are very concerned that agricultural irrigation drainage has been found to be in conflict with wildlife in the San Joaquin Valley. It's our conviction that if the master drain had been completed drain water would not have been concentrated by evaporation at Kesterson and that none of the present conflict would have occurred.

The drain was not completed, however, and the tile lines essential to the agricultural area upstream of Kesterson were installed. Because the drainage water could not be disposed of to the ocean, the construction of an evaporation sump was required. It was foreseen that the concentration by evaporation for such a short time would be detrimental to wildlife. We believe that the most productive solution to the present problem is to complete the drain to the western delta, entering the delta downstream of any point of extraction of domestic water. We are aware that it is not realistic to expect this to happen until there is a general confidence that the benefits would outweigh the possibilities of environmental costs. Other provisions must,

therefore, be made for accommodating the drainage, or agriculture in the service area will quickly decline. This places great urgency on the development and approval of affordable methods of treating agricultural drainage so that salts may again be disposed of to the ocean or to salt sinks.

Of course, there are other drainage areas in the state that do not have natural access to the ocean that are now suspected of selenium problems. These other sites further emphasized the importance of holding in abeyance any final State Water Resource Control Board clean up order on Kesterson until research efforts clearly point out the best practical way to treat the contaminated land and water. The issue is not just Kesterson, and it's not just the Bureau of Reclamation. It is not the Westlands Water District. The issue is how to deal with a by-product of irrigated agriculture that we didn't even anticipate until about five years ago. It's an issue that may affect several parts of the state. About two years ago, the State Water Resource Control Board found it necessary to require the Bureau of Reclamation to minimize the danger to wildlife caused by selenium. The urgency caused the board a year ago to act on the basis of less than full knowledge of the results of the various courses of action available to them at that time. We're not now criticizing the board for having chosen the on-site disposal option. The Bureau of Reclamation, however, while preparing to comply with the board's order encouraged continued research on other methods of clean up during the interim. It appears to us that this research has not produced facts which

need to be reviewed by the board before the Bureau begins to excavate ground surface and begins a process which may, itself, produce unanticipated hazardous results by uncovering additional problems. If there is anything we do not need at Kesterson it is a man-made mountain of contaminated earth creating a physical monument to society's tendency to deal with scientific matters in a political manner before the scientists have time to evaluate the solutions. The environmentalists could plant a flag with a skull and crossbones on the top of Mount Kesterson. It would outdo James Watt as a membership tool for the Sierra Club. Each year the argument over the federal budget for monitoring expenses would remind everyone how dangerous it is to allow irrigation projects to exist, and no one knows what to do with the dirt pile in order to actually neutralize the issue. It also appears that moving the topsoil off the ponds might expose a worse problem at the underlying surface. The Bureau of Reclamation has requested a re-hearing of the clean up order. We know the Bureau did not request this re-hearing without most serious thought. We urged them to request a re-hearing much earlier, but we believe they were in a dilemma caused by their earlier pledge to comply with the year old order together with their realization that most likely if the board knew a year ago what is known now, the board would not have adopted the present order.

We believe that even if the board reviews up-to-date research results, but for some reason still believes it must enforce its year old order, this hearing is worthwhile. The board has ordered the Bureau into an uncharted course that may be

much more expensive than anticipated. Because of that danger, it is essential that the board has the advantage of all possible information to ensure the validity of their action. As a result of re-hearing the order, the scientists have been allowed additional time towards completion of their fieldwork which will help them predict the rate of success in clean up by other methods. We think it is important for the board to bring a sense of perspective comparison to the issue of bird hazard. The chief danger seems to have been that a few coots have been lost during the last year, and maybe some blackbirds. The only thing we knew about coots was that they shoot them to protect San Francisco golf courses, and blackbirds we know lots about, and very few grain farmers or fruit growers are going to shed tears over the prospects of a decrease in the blackbird population. Is that why the government is rushing us into spending millions of dollars prior to the completion of research, to save coots and blackbirds? If so, we think the priorities should be re-examined. That might be an appropriate subject for your committee to consider.

We concur with and endorse the Bureau's request for next week's hearing. We are pleased that the board has agreed to consider the latest information, facts, and opinions of the institutions and the individuals who have continued their research for the twelve months since the board's action. As the board considers its options, we believe that it is important for them to consider that Congress may not be committed to spending unlimited funds on this issue. As you've heard before, four

congressional appropriations committee leaders have made that very clear to the Secretary of the Interior during the last couple of months. Other irrigated areas may be even less able to bear the local share of costs of clean up than Westlands Water District landowners are if selenium or other rare elements become problems to them and their districts. We believe it is far better that the board allow the facts to be developed to the board's complete satisfaction before demanding that any course of action be taken on Kesterson. What the board orders may become a precedent for other areas and few farmers or non-farming taxpayers want the state to risk proceeding on the wrong path when a little more time might have put them on a much better path. We are not satisfied that enough was known about the issue of selenium treatment to warrant the board's order of a specific course of action a year ago. We would not be surprised if that condition still prevails, but it appears more information exists now which must be evaluated and we're therefore pleased the Kesterson clean up matter is being reviewed.

We appreciate the Waters, Parks, and Wildlife Committee giving this matter its attention today. We believe the committee is destined to become much more aware of the many aspects of irrigation drainage in the near future. We are anxious to work with you in that endeavor. Thank you.

CHAIRMAN COSTA: Thank you very much, Mr. DuBois. Any questions or comments by members of the committee? All right, if you'll stay around, there may be a follow-up or two.

Next witness before us is Mr. Hal Candee, the senior attorney from the Natural Resources Defense Counsel. Ah, you brought company.

MR. HAL CANDEE: Thank you, Mr. Chairman. I'll introduce my friend here.

CHAIRMAN COSTA: Sergeant, you want to get another mike for the other witness, please.

MR. CANDEE: Mr. Chairman, my name is Hamilton Candee. I'm a Senior Project Attorney in the Western Office of the Natural Resources Defense Counsel (NRDC). With me today is Laura King, one of NRDC's Senior Staff Scientists. As you know, NRDC is a national environmental organization with over 17,000 members here in California and over 75,000 members nationwide. We have been directly involved with the Kesterson issue for many years.

We appreciate the opportunity to testify before this committee and to share with you some of our concerns about the current progress on the clean up of the contaminated Kesterson Refuge. First, however, I would like to highlight some key recent history about Kesterson.

In the State Water Resources Control Board's original 1985 clean up order on Kesterson, the Board found that serious problems had occurred there since 1981, beginning with the disappearance of most of the different types of fish that had been present at Kesterson and ultimately including widespread deaths and deformities of waterfowl and threats to other wildlife. This national wildlife refuge quickly became a toxic deathtrap due to the discharge of agricultural drainage.

Yet, it was not until June of 1985 that the Bureau of Reclamation terminated drainage into Kesterson. And today, on May 19, 1988, the Bureau still has not begun the actual clean up of this hazardous site nor provided a specific definite plan for mitigation of the lost wildlife habitat. During the seven-year period, we have seen a number of significant developments. First, the Central Valley Regional Water Board refused to take any action at all when the Kesterson problems were first brought to its attention in 1984. On appeal, the state board held hearings at which the U.S. Bureau of Reclamation urged the board to take no enforcement action on the theory that the Bureau could take care of the problem itself. In fact, in its closing brief to the board, the Bureau claimed that the board's proposed clean up order would cost over several hundred million dollars, that all the wildlife impacts could be eliminated by the Bureau's own management strategies, and that there would be no significant environmental harm in waiting another five years for further scientific study. Of course, we now know all of those claims to have been erroneous.

In its key 1985 order, the board found that Kesterson was a hazardous waste site that threatened drinking water supplies and the public health. The board wisely rejected the Bureau's plea for endless delay and unanimously ordered the closure and clean up of Kesterson by February of 1988. In 1986, after finally terminating drainage into Kesterson, the Bureau proposed an experimental clean up plan to the state board. It would simply flood the reservoir rather than remove its toxic

contaminants. The Bureau hoped that its phased approach, that's what it described it as, would buy it more time for further study, but in fact it would delay any serious clean up. In a candid description of its clean up goals, the Bureau's secretarial issue document on the Kesterson clean up revealed that the goal of all the Bureau alternatives was to retain Kesterson's availability as a disposal facility for agricultural drainage. Once again, the board rejected the Bureau's request for further delay and ordered a completion of a traditional clean up by August 1988. They gave them an additional six months. The chosen method was the Bureau's own alternative proposal, known as the on-site disposal method. Although the Bureau never challenged that order and, indeed, even promised to comply voluntarily and even though Congress has already appropriated over $20 million through this year for the task of the on-site disposal plan the Bureau has once again sought a new delay.

In a new stack of documents which you all just saw in here, a very large stack of documents that was just released to us on Monday, that is only three months before the board's August '88 clean up deadline, the Bureau has now rejected its own previous flooding proposal. As you heard today, Mr. Chairman, wetflex is not longer in with the Bureau, they're moving to dryflex. But the Bureau's new proposed alternative strategy involves further study and further delay, but no real clean up.

Since the Bureau's new proposal will be the subject of full evidentiary hearings before the State Water Resources Control Board next week, we will not attempt to argue the

technical merits of this latest proposal to this committee. However, we believe the Bureau's consistent pattern of resisting a full clean up while always proclaiming its voluntary compliance must be kept in mind. In addition, there is an accompanying pattern involving the Bureau's approach to the state's jurisdiction that we believe deserves this committee's consideration. When this committee held joint hearings with the Senate concerning Kesterson on November 16, 1984, Mr. Houston of the Bureau assured the committee that the Bureau was working from an assumption that "we are under full jurisdiction of the state." That's from the transcript on page 57. His view was immediately confirmed by the Interior Department's regional solicitor who advised this committee that the normal rules of federal preemption did not apply to Kesterson. This view has now been reaffirmed by both the state and the regional water boards in their Kesterson orders, and of course, it's explicit in the federal Clean Water Act. Yet, the Bureau has not changed its tune. Now that the boards have handed down direct orders to clean up the refuge and to provide full mitigation including land and water for habitat, the Department of the Interior has backed off into a claim of federal solvent immunity. Thus, for example, all of the recent statements by Interior about compliance with the state's Kesterson orders have emphasized that the department is only doing so because of its "voluntary" choice to work within the state board's framework. More significantly, with respect to the mitigation issue, the Interior Department has said flatly that "the regional board lacks authority to require the

department to undertake mitigation actions in connection with either its past operation or planned closure and post-closure maintenance of Kesterson Reservoir." That's in the brief that the Bureau submitted to the regional board this summer.

In our view, the department is clearly wrong on this issue. We are pleased that the regional board has agreed with our analysis and ordered the department to provide full mitigation at Kesterson. However, despite a January 1988 deadline for providing the full mitigation plan, the Bureau now claims it needs until August to decide what mitigation actions it will actually take. Moreover, the Bureau has repeatedly announced that it may not comply with the board's final order in any case and refuses to recognize the board's jurisdiction on this issue. We believe that the state must keep this attitude in mind. Particularly since the Bureau has just petitioned the state to allow its "place of use," that's the Bureau's service area, by 4 million acres so that it can sell an additional one million acre-feet of federal water around the state.

In light of the numerous environmental problems associated with Bureau projects, not least the drainage problems of its customers, we believe there must be a full commitment by the Bureau to compliance with state requirements for environmental mitigation and protection.

Thank you for the opportunity to testify. We would be happy to answer any questions.

CHAIRMAN COSTA: Mr. Candee, any questions by members of the committee? Mr. Jones?

ASSEMBLYMAN JONES: The other members that have testified, the other individuals have stated a position on the Bureau's request. I hear from you historic perspectives on your attitude concerning the Bureau's action or inaction, which we're interested in, obviously, and obviously you have every right to believe, but I would like to ask the question of what your feeling is concerning their proposal.

MR. CANDEE: Thank you, Mr. Jones, for giving us that opportunity. Frankly, the Bureau's proposal is very voluminous and detailed. It is a new proposal. It is not the wetflex, it is a new proposal. And they just gave it to us on Monday. The board asked us to have our comments. We thought that was a bit unfair. But I will say, we are prepared to give testimony...

ASSEMBLYMAN JONES: I realize the information is thick and if you have not had time to review it, that's fine.

MR. CANDEE: We do have some preliminary views on it, and perhaps Laura King could speak to that. I would just say that my central comment at this point is that it's not a clean up plan. It's a plan to dry out the environment and to study clean up alternatives. Last year's plan was a plan to flood the environment and study clean up alternatives. The basic concept behind the state board's orders in 1985 and 1987 was clean it up, remove the problem, and the Bureau has never wanted to do that. As I said in my testimony from day one, they've wanted five years to do scientific study. The board has been very open to having scientific study and research accompanying the clean up activities, but the board has really shown and interest in having

clean up, and my initial comment on it is that this is not really a clean up plan.

CHAIRMAN COSTA: Do you consider burial a clean up?

MR. CANDEE: I think if you can eliminate the exposure and put the toxic contaminants into a sealed landfill that is not..., I should defer to the scientists on our staff, but that...

CHAIRMAN COSTA: Well, you made the comment. You do consider burial a clean up method?

MR. CANDEE: Right.

CHAIRMAN COSTA: Mr. Jones, please go ahead. I didn't mean to interrupt you.

ASSEMBLYMAN JONES: No, that's fine. I was just endeavoring to..., if you had had a chance to review it. I think the basic question here is, I asked Mr. Houston earlier. Just in the brief time I've been in the legislature and some of the discussions on different measures dealing with the site, it seems that we, in the legislature, have got into the scientific arena, much more so than I would like. I've, in turn, learned more than I've ever wanted to know about a variety of subjects I never wanted to know about.

Nevertheless, times change, information changes, and while I understand your point about on-site disposal, wetflex, and now dryflex, or whatever you want to call the term, I think that the gist of all this, and Mr. Costa, Mr. Harvey, myself, since we all have these concerns, as I think legitimately you do, and the Bureau has these concerns all over, is that we come up

with something that doesn't just seek to try to justify someone's past decision or past position. We seek to come up with a conclusion that will provide us some leadership for the future, and I haven't heard any of the individuals, supportive or not of the proposal being suggested by the Bureau, that have not been supportive of dealing with the problem and trying to deal with it expeditiously, as I think most people are.

I think the question here is, and I know I've found with some of my drinking water bills, the technology is moving so fast because it's so new, it's hard to be right all the time and it's hard to come up with something that works today that..., you know, there might be a better way to do it tomorrow.

So, going back to my question, the way I was approaching this in listening to the conversation was trying to understand if in fact this approach that's been suggested is not workable as to what the original needs of the problem were, which was drying it up, removing the..., making it benign, I think, the adjective that was used by one of the witnesses, and if, in fact, we accomplish that and we can learn something through the process of either the wetflex or the volatilization is that not a benefit, realizing everybody wants to move toward the most economical clean up. That's the reason, even though you haven't had a chance to look at it, I asked the question as to your position and I'd defer to your scientist, as you said, because I think you might want her to comment on that.

MS. KING: Well, I'd just add to what Hal said, Mr. Jones. First of all, our reaction is we're very pleased to see

the Bureau backing away from wetflex. We were very, very, concerned about that and we thought that would create very serious problems. One of the main reasons that we thought that would result in big problems is that it would leave the selenium out there, accessible, and I guess the concern we have about the failure of the Bureau to propose an actual clean up plan at this point is the selenium is going to be left still out there, albeit in a so-called dry management form.

I guess that's basically what still concerns us. We see the Bureau coming in with proposals to disc cattails and then use herbicides and insecticides if necessary to keep wildlife out. That seems to us to be adding more toxic substances rather than dealing with the toxic problem we have there.

MR. CANDEE: Can I just add one thing to that? There's an assumption that's run all through this hearing and it's run through the debate that we've all been reading in the newspapers and the congressional correspondence, that the only alternative to on-site disposal plan is going to be something cheaper and that if we could just get that, I think a lot of people are hoping if they could just get the board off of on-site disposal plan they'll save money. It's not, to me, absolutely clear that the board will choose a cheaper alternative. It's entirely possible that the board will choose a much more expensive alternative if it moves off of on-site disposal plan, because it may decide that it needs to move this stuff off-site. These levels of selenium are so high and there may be problems with the on-site facility. Perhaps they'll start talking about an

off-site disposal solution. It could be that the variance that was originally granted by the Department of Health Services because of the hazardous levels in the sediments might not still apply, and yet they may require that it be moved off-site. We could be talking a much more expensive clean up.

Also, by delaying a year, that may increase the cost. Also, you've got the money in the bank right now from Congress. You may have a harder fight in the future. These are unknowns. I'm not saying they're likely to happen, but I don't know that it's responsible for all of us to assume that the alternative is going to be cheaper. In fact, the on-site disposal plan, to a certain extent, was a compromise. The Bureau had originally looked at off-site disposal and then decided to go with on-site disposal plan, and that's what the board adopted.

ASSEMBLYMAN JONES: From what I've heard, we do know some things for sure. One, we know that the comment that was made by Congress that, while there are some funds available this year, the comment I saw in the paper was that no funds were going to be available next year. That's the word, the statement, I saw. I'll take that at the statement value for the time being. So, within those restraints, I think, regardless of this problem, no matter what we were talking about we'd be required to look at the most economically feasible approach, nevertheless, that met the health and safety requirements, and since we're not really talking about human health, we're talking about fish and wildlife more so, but met those requirements, but within those parameters, I think that's what we have to deal with, and I think that's what we're all trying to do.

I wanted to comment on the statement that the young lady made on the question of the selenium issue. I think, as oftentimes happens, selenium and pesticides and herbicides are all put in the same topic. They are not the same, obviously, as you're all aware. We're talking about a naturally occurring element that throughout the coastal range you can walk anyplace you want to walk, through my district, Mr. Harvey's district, Mr. Costa's district, you're going to find high levels of certain trace elements. That's just a fact of nature, as you're well aware. What we're really talking about here is how we best manage this one particular high concentration, and I don't think, necessarily, if we were dealing with pesticides or DDT or something along those lines we'd be approaching this totally differently than we are, so I think there needs to be a clarification because sometimes that becomes gray, that we're dealing with something that is not native and is not indigenous to the area. The problem we have here is a management problem, as I perceive it. The problem is how we use state of the art technology that we're learning all the time to try and deal with this most appropriately, and we have the mitigation problem that you mention, and I think you make a good point there that needs to be addressed. But our real concern here, as I know, I've heard the comments, everybody talks about this particular area. Mr. Harvey's got problems, Mr. Costa's got problems, Mr. Kelly was here, and if Mr. Peace were here, they've got problems down south, you know, and nevertheless, what concerns us is not just this particular area but setting a precedent that we are going to

be forced to try to follow or to try to justify down the road. That is a major concern to us, and the delay that has taken place on the part of the Bureau, notwithstanding, they did not ask Congress to ask them to be careful in the spending of the money. We may have differences of opinion on that, but Congress has got the same problem we have. So, I think we're all trying to focus on that same issue. I don't think there's any difference of opinion, although historically we've had differences. I think what we're really working toward is how do you manage this particular high trace element area effectively so we can use the same management technique in other areas.

So, I'd like to get your feeling, and next week, obviously, you'll present your thoughts on it from that standpoint, and if we can, to some extent, divorce ourselves from historic perspective on this issue, as Mr. Costa mentioned, and try to deal with this issue as it might be a precedent setting issue for the future. Because that concerns a lot of us who have to get the drainage problem behind us, but at the same time we've got to come up with some solutions, too.

CHAIRMAN COSTA: I appreciate your comments, Mr. Jones. Mr. Candee, as you know I am on record as supporting Order 87-3. I also concur with the statement you made that, in fact, the Bureau is under obligation by the state board to comply with the orders that they have promulgated, and that there is a responsibility there. I know that from time to time the Bureau has disputed whether or not they are voluntarily doing so because they are good guys or whether or not they are, in fact, under

order based upon the law between the state and the federal jurisdictions.

Let me ask a couple of policy questions, and then I have some scientific questions as well that I want to focus on with Ms. King. From a public policy statement, you've been critical of the Bureau and their past proposals and seem to be somewhat critical of this proposal as well. Do you believe, or have you sat around in your office and have your feet kicked up on the desk, any thoughts about how we might, from a public policy standpoint, provide a solution that provides greater environmental protection that may be less costly, or when you're thinking about the deal and how you resolve this problem from an environmental standpoint, do you even focus on the cost aspect or do you believe there's a way we can deal with it environmentally that will cost more, but the environmental returns are such that it doesn't matter about the cost?

MR. CANDEE: The answer is definitely yes, we do.

CHAIRMAN COSTA: You sit around in your office with your feet up on the desk? Good, I'm glad we've got that clear.

MR. CANDEE: I'd like the record to be clear on that.

No, quite seriously, we've given a lot of thought to the kind of policy issues you raise, both in terms of what's the best solution and also what are the costs involved. It's not coming out of our pocket directly, although as taxpayers we're all concerned, but also, as environmentalists, if you are advocating cleaning up the environmental you want to make it as cheap as possible so that people are encouraged to do it. It doesn't help

the environmental community to have toxic clean up be an expensive proposition. All that does is create more roadblocks.

For example, as I indicated earlier, the selection of the on-site disposal plan was a compromise by the Bureau, by the state board, and by NRDC and the environmental community. It wasn't, perhaps, explicitly termed that, but if you go back into the earlier hearings before the state board's 1984 and 1985 order, it was assumed that we'd either be double-lining the Kesterson facility or moving all this stuff off-site, and neither option has now been chosen, but those are very expensive options. When the Bureau came forward with the on-site disposal plan, which did have some questions and everybody knows that, there had to be certain waivers by the state board. They had to agree to put in the flood plain and that sort of thing, and our view was that it was worth it, those compromises, to go with the on-site disposal plan because the difference in costs was one factor, but also we thought it would be an effective plan, at least more effective than the wetflex. So, that does enter into our thinking. On the other hand, I think environmental protection is a good long-term investment, even if it's expensive in the short term. You don't want to leave the selenium out there, leave the toxic situation, that's going to have larger costs down the road, so it may be that you have to spend a little bit more in the short term in order to prevent a long term problem.

CHAIRMAN COSTA: Okay, but specifically in the period that's ensued in the time since Order 87-3 was issued and that compromise was reached, new information has come to light. Based

upon that new information, has NRDC or any of the other groups that you've spoken with, the environmental groups, thought about that, based upon the new information, that maybe there is a better way to do this?

MR. CANDEE: Well, I obviously can't speak for the other environmental groups, and as I say, we have a preliminary review at this point. We'll give more detailed testimony, but I...

CHAIRMAN COSTA: I'm not talking about reacting to the Bureau now. I'm talking about based upon the information that the San Joaquin Valley Drainage Task Force has brought together and the U.C. studies and...

MR. CANDEE: I would say, first off, the most important thing that has come out of all these studies, and it's very important that the state board, the Department of the Interior, and the Department of Water Resources, everybody that's been involved in this process, the most important thing that's come out of course is water conservation. The way to reduce your drainage problem, first of all, is to reduce the amount of drainage, and although you still have a treatment issue, you still have a question of what do you do with the drainage, one always has to go back to that basic principle, and I think, to their credit, the growers, the water districts in the valley, are accepting that basic proposal, that we have to reduce the amount of our drainage. Remember, that's the first thing that happened in Westlands when the whole Kesterson thing hit, the Westlands Water District was out there paying for consultants to help people reduce their amount of drainage, and that was an

investment in money that paid off in terms of reduced drainage, so that's point number one.

In terms of reviewing the new data, obviously, one has to consider it. We've been considering it all along. We were, frankly, a little bit distressed. The Bureau, it was in November that they came out with most of this new data about the problems with on-site, the new better results at wetflex, and if we'd known then that they were going to come forward on May 13 asking the state board, with the results of all of that, asking the state board to change their mind, we would have said, "Well, look, do it in November, do it in December."

ASSEMBLYMAN JONES: I think, in all fairness, Mr. Candee, Congress injected some new ideas into this process. They have a right to, as we have a right to, so I don't know that it's fair to focus on the Bureau.

MR. CANDEE: That's a good point. I wasn't at the hearing. My understanding was that at that famous hearing in March, the Appropriations Committee, the exchange went something like, Chairman to Secretary of Interior: "You don't sound enthusiastic about your plan. You've been telling us about its problems." "Yes, that's true." "Well, why don't you ask the state board to reexamine it?" Perhaps there was a reluctance on the part of the Secretary of the Interior, but it seems to me the congressional directive, if you will, was really a response to the Interior Department encouraging...

ASSEMBLYMAN JONES: I think the issue, though, that the appropriations committees are concerned about money. Their issue

is, back to Mr. Costa's question, is there a more cost effective way to deal with the problem. You know, it's totally appropriate for them to ask that question, and it's totally required of a secretary, just as it would be the secretary of here, if Mr. Costa asked the question, to deal with that issue. So, I think it's a two way street there. I just want to make sure that, at least, the letters that I've seen related to that cost issue, not that that's the only issue but of course that's the issue they're concerned with. And I think there's one other aspect that needs to be kept in mind, and that is that, while our focus today, here, is basically on the public policy and the science, although few of us here are scientists, but the fact of the matter is that this is a political environment and the decisions, as I said earlier, one of the factors that went to my process in supporting Order 87-3 wasn't necessarily because I love that solution but because politically I wanted not to have to open the San Francisco Chronicle and see about Kesterson as I'm trying to come up with solutions to dealing with the drainage problems. As long as it was convenient for folks who have, I think, a different focus to be able to use Kesterson as this convenient political football to kick around I thought it negatively impacted our ability to get our eye on the target, and the target, I think, long term is to deal with the drainage related problems. I think we're going to resolve Kesterson in one fashion or another, whether it's this solution or some other solution, that we ultimately deal with it, so it seems to me that we have to be mindful of that fact, so I mean the order of events in terms of

how the Bureau finally came here and, I don't think, and the Congress, while that's important, it's not central to my question and that is, do you folks think there is a better way to resolve Kesterson that may be less costly? Or do you have another way?

MS. KING: We don't have contracts with the Lawrence Berkeley Laboratory. We have one scientist working on this issue, and I haven't developed a cheap solution yet.

CHAIRMAN COSTA: Ms. King, let me ask you a few questions. Let's deal with it as a scientific question. If the on-site disposal is pursued and Kesterson Reservoir still presents a threat to the environmental through the selenium remaining in the soil, and in the ephemeral pools that Mr. Houston described earlier, then what have we gained?

MS. KING: I think that we're going to have to deal with the ephemeral pool problem regardless, whether we go forward with on-site disposal. I think what we've gained, if we do go forward with the excavation, is the security of knowing that 80% of the selenium inventory has been isolated from the environment. I think, given the unknowns about how selenium is transported through the ecosystem, that is a very valuable security, something that I, for one, would sleep a lot better knowing it's the case.

CHAIRMAN COSTA: So, for $100 million, you're saying we cleaned 80% or approximately thereabouts, 80% of the selenium but we're still going to have to deal with, down the road, the downsides of the on-site entombment, or burial, process?

MS. KING: Well, I'm not prepared to say what the cost would be. We've heard some estimates from the Bureau. We have not had the opportunity to see how those estimates were derived, and I hope that's something that will happen next week in front of the board. My understanding is the bulk of the costs are going to be associated with dealing with the ephemeral pools in the way that the Bureau is now making its estimates, and I would suggest that those costs would be incurred in either case. But I would also suggest there may be less expensive ways of dealing with the ephemeral pools and I hope that's what the Bureau is thinking about when it talks about its various research programs.

CHAIRMAN COSTA: Then, you're not prepared at this time to state whether or not you think there's a better option than the on-site proposal?

MS. KING: I think that we're going to have to go forward with the on-site disposal and we're also going to have to come up with a solution for the ephemeral pools. I think there are a variety of solutions that could possibly be much less expensive than the $100 million estimate that the Bureau has come up with.

MR. CANDEE: Mr. Chairman, if I could just add to that. The $100 million figure definitely does not relate to the on-site disposal plan per se. It is, to the extent it has any relevance at all, it is a figure, part of a range. The Bureau issued a piece of paper that had $13 million to $96 million, and that was the range of management actions to be taken after the on-site disposal plan, and as Ms. King just pointed out, to some extent

you're going to have to deal with the ephemeral pools, whether you...

CHAIRMAN COSTA: I'm not stating that...

MR. CANDEE: The $100 million figure, the only figure that we've heard close to that, this $96 million figure, is part of a range from $13 to $96 million that the Bureau preliminarily submitted. They never asked Congress for that money, for example. It hasn't gone through the whole review process.

CHAIRMAN COSTA: No, but that was, in part, some of the thinking that went into the Budget Subcommittee's thought process when they asked the Interior to say..., "is there some other way to do this, guys?"

One more question, Ms. King. From a scientific standpoint, is Kesterson in a dry state, in your opinion, a significant threat to the environment?

MS. KING: I have heard some indications that there are problems with that. I have not seen the evidence that this is based on yet and I hope to have it by the hearing next week. I think that the problem is whether that inventory can be kept isolated and be kept dry.

CHAIRMAN COSTA: A policy question. Back to you, Mr. Candee. Given the federal deficit and the state situation which isn't as bad but it's not very good, in the sense that we don't have a lot of dollars to spend, how would you rate Kesterson in terms of budget priorities with the host of other environmental problems. (Laughter). No, I'm very serious, because some of those environmental problems are here in California, and as

Chairman of the Water, Parks and Wildlife Committee I have concerns about water problems on a regional basis throughout the state, such as the national estuary project, our attempts to continue to clean up in San Francisco Bay, provide for expansion of the Superfund. We had just this recent spill out near Martinez, the oil spill, that dealt with industrial discharge. In that case we had a pipe break. We have mining wastes that the state board now is dealing with that I suspect you're involved with that is a concern. We have contamination in the New River and the Alamo River and the Salton Sea. There are other areas in which we have a real toxic mess that I've seen and I've tried to help provide state funding, bond funding for the clean up of New River, provide some means to deal with that. And so, I have, as I think you do, share a number of concerns with specific environmental problems we have throughout California, and I know you, in your wish list, and me, in my wish list, would like to wipe the entire slate clean and address all of them simultaneously, and clean them up tomorrow and then go about the business of other things we want to do. Unfortunately, you and I both know that the world doesn't work that way and neither does the federal or state bureaucracy. We are not equipped to do that in one fell, clean, swoop. So how do you rank Kesterson with that overall statement? How do you rank Kesterson in terms of all of those problems that we're dealing with? That is of concern to me and you've got to realize that I represent Kesterson. I represent the problems that created Kesterson, i.e., the drainage water, and I can tell you that no one wants to

see Kesterson closed and go away any sooner, any quicker, and environmentally in a way that is satisfactory to all those concerned than I do. Kesterson is a big pain. I want to see it go away, in a fashion that will satisfy everybody to the degree it is possible, so let me tell you, you've got to understand, I am not an advocate of keeping this thing around. Even though I don't represent the exact area where Kesterson's located, but I want to see it closed, so where do you rank it?

MR. CANDEE: Well, Mr. Chairman, first of all, I appreciate very much that you want to put this whole Kesterson problem behind us and I guess you and I are in total agreement on that and perhaps there's some other institution out there that's making us keep dealing with the ongoing problem with Kesterson. We've been pushing for an early clean up and an end to this thing as well.

One of the things that you folks, as elected officials, have to do that we folks at NRDC don't have to do is play that multiple choice game, unfortunately. We don't have to make those priority decisions in terms of actual allocation of dollars. We do work on a lot of those issues, and I'm not prepared to say one is more urgent than another and somehow that it's okay, therefore, to ignore one of those, and...

CHAIRMAN COSTA: I'm not asking you to advocate that we ignore any of them, because we can't. What I am asking you to do is to try to give us the same sort of assistance you give on a regular basis when you testify before committees and you provide your expertise and your concern for environmental damage,

potential environmental damage, and give us that sort of input that helps us make balanced rational public policy choices. And I guess what I'm saying here is that I've got this priority that I want to deal with very quickly and to deal with it in a fashion that's environmentally sound, but my question to you is, given other environmental problems that we have, in the Valley and in other parts of the state, where do you see this as in terms of how we deal with it, and realizing that it also, as Mr. Jones said, potentially offers the precedent, Ms. King, as toward how we may deal with other problems that are similar, that have selenium, a natural toxic elements, and how you deal with those.

MR. CANDEE: Well, again, first of all we clearly think Kesterson is a very important environmental problem. We wouldn't have devoted as much time and effort as we have to trying to clean it up. We did consider it very serious. And I think the entire drainage problem is a very serious one, as you recognize better than anybody. It's a problem that has environmental significance throughout the west, and I think you threw the Bay-Delta issues in there. Well, the drainage is coming up in the Bay-Delta hearings too. So a lot of these problems are interrelated, but we think Kesterson is very important. Again, I just can't rank it as slightly more important than this or less important than that. I do think it is worth taking the trouble to implement a serious clean up and that's why we've advocated that position all along.

I will say one thing about allocation of resources, though. The Bureau of Reclamation just submitted a document in

federal court. They estimated that the federal taxpayers have already lost, or have invested, six and half billion dollars in water subsidies to the Central Valley Project alone, and that there is one farm operation in Westlands I think that has received $75 million in subsidies. It seems to me, as a public policy matter, it is much more valuable to spend $6.5 billion or some portion of that, or $76 million, on cleaning up the environment, which benefits all of us, than to provide it as water subsidies that exceed the original goals of Congress as a lot of these do, so that's where we come down. In terms of the balancing that has to go on in legislatures, we see the Bureau of Reclamation spending a lot of its budget not implementing the Reclamation Reform Act, for example, not doing what it could do to enforce the acreage limitation laws and that sort of thing, and it seems a shame to us that the one area of their budget which suddenly is too small is the clean up budget for the problems that have been created and not some of these other areas, so I'm sure that's not the answer that you're looking for but that is the kind of priority decisions that we would make.

CHAIRMAN COSTA: In the area of mitigation, it was discussed earlier on whether or not we might look upon other forms of means or mitigation to allow for further closure of this. Do you..., you touched upon it, you didn't speak to it specifically.

MR. CANDEE: Well, with regard to mitigation, there are two issues. First, there's a very serious need for additional fresh water for the wildlife refuges. The Bureau has been asked

by the waterfowl interests and the fish and wildlife service for more water for one thing...

CHAIRMAN COSTA: And by the wildlife folks. Mr. Chapin's here to make that case.

MR. CANDEE: I'm sure he will make that case, and so there is an urgent need. What you have at Kesterson is a wildlife refuge that was providing habitat for a period of time that is now destroyed. It's contaminated and it's not available for habitat, and it seems to us that in a time when we should be enhancing waterfowl habitat, when you contaminate existing habitat you certainly have to mitigate for that, and that's what the regional board said. They said, "Go back and come up with a plan that has short term mitigation. That's what you're going to do now, while you're cleaning it up, and then a long term plan for habitat." And there are a lot of different options, but it's probably going to involve an additional commitment of water by the Bureau as well as, perhaps, other things.

CHAIRMAN COSTA: All right. Any further questions?

Mr. Candee, we appreciate your time and your comments.

Our next witness is Mr. Dan Chapin with the California Waterfowl Association, and we have two witnesses to follow Mr. Chapin, and that's Mr. Dave Kennedy and Dr. Ulrich Karlson.

MR. DAN CHAPIN: Mr. Chairman and members of the committee, my name is Dan Chapin. I'm the chairman of the Resources Committee of the California Waterfowl Association. I had not originally intended to make any comments this afternoon. Like many of the other people here, I haven't had the chance to read the Bureau's new Encyclopedia Britannica.

CHAIRMAN COSTA: It'll give you something to do this weekend in your spare time.

MR. CHAPIN: Actually, I've been working on one of your pieces of legislation continuously since this new document became available, so, as a result, these are simply comments. This is not a statement of CWF, California Waterfowl Association position, but hopefully these comments will be helpful.

One of the things I think is important to recognize with respect to Kesterson is that when the reservoir ponds were created this was done by scraping up material and building them and putting in the levees. In the process of doing that, the Bureau created a sump. The elevation of the ground level of the ponds today is lower than the surrounding land levels, so you already have a sump. A second thing that seems to us to be of significance is that when the Bureau's original proposal was made it contained the idea of using wetflex in the southern ponds, but its proposal for the northern ponds was essentially what they are calling dryflex. We pointed out at the time that there was a sumpage problem and that as the groundwater table rose in the winter time that these ponds would be flooding and that the selenium which was contained in them would become active and, in fact, that is what has been demonstrated to actually occur over the last couple of years.

So, the idea that these ephemeral pools are generated and that they are hot is something we told you folks and also the state board was going to happen two or three years ago.

CHAIRMAN COSTA: In other words, you don't want to say, "I told you so," but...

MR. CHAPIN: Well, it shouldn't come as any surprise, is what we're saying. The entombment proposal obviously increases the depth of this sump and is, as has already been pointed out, is going to increase the extent of ephemeral pools. It seems to us that the underlying consideration here goes something like this: at Kesterson, the source of new selenium has been terminated. You do not have new material coming in. And what we're really trying to do is to deal with the selenium that's there and, preferably, figure out a way to get it out of the system. Now, one way is to pile it up. The volatilization approach is another potential one. The Bureau today has mentioned another, a third approach, which is to actually grow crops out there which would absorb the selenium and could possibly be used as animal feed in areas which are selenium deficient, and this is not a new proposal either. This was made three years ago.

Our grasslands people have taken a look at a fourth possibility and that is to control the level of the groundwater table by tiling the Kesterson ponds and collecting, as the groundwater level comes up this season, to collect that water and put it in another ditch, not in the sump, and inject it with with deep level injection. This is just a thought that has occurred. It's been discussed with the Fish and Wildlife Service people down there and some of our people.

CHAIRMAN COSTA: You look at that as a fourth alternative?

MR. CHAPIN: Yes.

CHAIRMAN COSTA: Is that one that you specifically...?

MR. CHAPIN: Basically, we're suggesting that it be looked at. We don't really know whether it's feasible or not. The mud on the wall number that's been generated has been something in the neighborhood of a million bucks for the tile drain system, but if it resulted in controlling the groundwater, preventing the surfacing of this ephemeral pool problem, it might be cheap at the price, particularly if control of the ephemeral pool problem involves not just regrading the land of Kesterson but also importing new fill, so that you really do get the land above the water table.

However, what I would really like to touch on today is something that hasn't been touched on very much except you figured I was going to get into it, and that's the question of how to replace or offset the loss of wildlife values at Kesterson. And, again, what I'm going to say is nothing new. We've been saying it right along. One of the proposals which has been made is the creation of substitute habitat in the amount of 1300 or 1280 acres, and the cost of doing that has been priced out and we've evaluated that, and I will be happy to submit to the committee our analysis of the cost benefits obtainable by that alternative. But what we really need to recognize here is that Kesterson is a very minor part, in terms of priorities, of the problems in that part of the world.

CHAIRMAN COSTA: You're willing to give us some perspective on ranking?

MR. CHAPIN: You bet. This is an official CWA position because it's been this way for three years.

CHAIRMAN COSTA: Someone want to call that Bee reporter back? I'm sorry, say again.

MR. CHAPIN: And that is that dealing with the selenium problem in the 75,000 acres of wetlands surrounding Kesterson is a far more critical issue in terms of resource benefits and waterfowl problems than taking care of Kesterson itself. So that's not a new statement.

With respect to alternative ways of offsetting lost wildlife values, the use of water, offsetting them by either one of two ways, is environmentally acceptable, it is demonstratively superior. The wildlife refuges down there have a current level of water supply which they are enjoying. It's not a firm water supply, but it is at least there. The Bureau has just about completed a very extensive evaluation and study they call their Central Valley Refuge and Water Supply Study and this has analyzed in a great deal of detail the potential for doing different things down there, and there's clearly a potential for improving the quality of the habitat in the refuges down there and also in the grasslands water district.

CHAIRMAN COSTA: Has the waterfowl association approached the Bureau as they've discussed this potential million acre feet of potential water for purposes of contracting for a portion of that water?

MR. CHAPIN: Well, Jim, the answer, certainly, is yes. When the coordinated operating agreement legislation was enacted a clause was added to it reserving 25% of that uncontracted for yield until the duck water issue was dealt with, and we are the folks who proposed that amendment. So, yes, that is a potential source. Now, we certainly are not saying that the resolution of all the duck water problems has to come out of CVP yield. There's clearly other water sources which are entirely feasible for doing this, and we're in the process of working with the Bureau right now to try to make sure that these alternatives are considered.

CHAIRMAN COSTA: I'm hoping that you'll keep myself and other members of this committee informed of that. I think many of us would like to try to be of some assistance to ensure that not only with the CVP but with some of the other sources that might be available, that we try to find some fashion to deal with that.

MR. CHAPIN: Let me give you a very simple example, but a very obvious one. Last fall, the Grasslands Water District entered into an agreement with the Bureau to conduct a full scale pilot evaluation of the feasibility of using the duck ponds in the grasslands as an off-stream water storage site. This is a win-win type of approach where the Bureau got a free reservoir and the grasslands got 24,000 acre-feet of water that it otherwise would not have gotten. The test appears to have been, given the winter weather that we had down there, appears to have been successful, and hopefully we're going to give it another

year's worth of look-see, but there is another aspect of this that I haven't mentioned yet and that is the situation down there in this 75,000 acres is not just a question of the potential for improving waterfowl habitat. The cold-blooded facts of life are, and I'm going to use the Grasslands Water District as an example, it historically had a water usage of about 125,000 acre-feet of water per year, and of that 125,000 acre-feet, 75,000 feet was agricultural drain water. Now this is not an optimal match but this is just the way things were operating. The loss of that agricultural drain water supply leaves them with 55,000 acre-feet. It takes 85,000 acre-feet each fall to saturate the soil profile and create the waterfowl habitat for duck ponds. You can't do that, obviously, on 55,000 acre-feet, so this isn't just a question of an opportunity to increase waterfowl values by providing additional water in the area. This is a requirement in order to avoid losing 47,000 acres of wetlands, and when you evaluate the alternative ways of offsetting habitat losses at Kesterson, it seems to me very clear that the most cost effective way that you could do that is to prevent additional loss by allocating the rest of the existing wetlands in production.

CHAIRMAN COSTA: I understand that, Mr. Chapin, and you have made that case consistently, loudly, and clearly. A couple of quick questions as it relates to this, and we need to move on because I'd like to give the other two witnesses a chance to testify and it's been a long day.

What you've heard about the proposal, the dryflex system that the Bureau's now advocating next week before the board, what are your thoughts on that, very briefly?

MR. CHAPIN: Off the cuff? If the activities that take place do, in fact, result in a dry habitat, then I think you've made a major step forward, because waterfowl usage of it would be extremely limited. It would, in fact, for practical purposes not exist.

CHAIRMAN COSTA: No, they wouldn't want to hang around there.

MR. CHAPIN: That's correct, and so if what the Bureau is proposing does result in dry land, why then, you've made a major step forward.

CHAIRMAN COSTA: Do you have any other thoughts about how you might close Kesterson that's environmentally...?

MR. CHAPIN: Well, the only way you're really going to clean it up is to get the selenium out of there, but if you can create a situation which does not have adverse wildlife impacts and at the same time gives you the opportunity to pursue techniques that will physically remove the selenium, I think you're headed in the right direction. We have the same concern that everybody else does. There is similar type of contamination down at the Hacienda Ranch and the Tulare Basin, at Lost Hills, the Salton Sea, and if we're going to get all of these cleaned up we need a technique which is going to do it extremely economically.

CHAIRMAN COSTA: And that technique, you believe, is...?

MR. CHAPIN: Obviously, if you can get the bugs to eat it for free, well, comparatively for free, or if you can grow an agricultural crop and sell it so that it becomes an income

generator instead of an income dissipator you're moving in the right direction.

CHAIRMAN COSTA: So, off the cuff, you're saying that dryflex system could be acceptable as far as you're concerned?

MR. CHAPIN: If a system which results in dry land, whether that is dryflex, as the Bureau describes it, I don't know yet, but a system which results in dry land and provides offsetting habitat, offsets the loss of wildlife, it seems to be a promising direction to go.

CHAIRMAN COSTA: All right. Any other questions or comments?

Thank you very much, Mr. Chapin.

Mr. Kennedy, chairman of the San Joaquin Valley Drainage Program, and he's our second to the last witness this afternoon.

MR. DAVID KENNEDY: Good afternoon, Mr. Chairman. I do not have a written statement. I had a few comments I'd make, but I think I'd like to devote most of the limited time to answering questions, and given the late hour we would be happy to, at some future time, bring in some people to maybe hold an informational hearing on the program itself, because there are questions, a lot of information has been developed and we have various experts that we could bring in at your convenience.

CHAIRMAN COSTA: Okay.

MR. KENNEDY: Whatever time you'd like to take this afternoon, but let me make that offer to you.

CHAIRMAN COSTA: I may be more than willing to do that at a later date. Why don't you summarize over the next five

minutes or so as to your view of the situation and some of the other things that are going on?

MR. KENNEDY: Just, really, a few comments and observations. We and the Bureau, or we and the federal government, the Department of the Interior, are spending a great deal of money right now, trying to answer the kinds of questions that you've been wrestling with for the last couple of hours, and I guess, I can't resist making the observation that, to some extent, the Bureau has been pushed into trying to get out in front of the facts that are presently available about even what the problem is, let alone how to deal with it. I can't sit here for two hours without developing an awful lot of sympathy for the position the Department of the Interior finds themselves in, where many of us were urging them to comply with the board order, putting it in the simplest terms, to make the problem go away, and I think what they've found out over a year and a half is that there's no really simple way to make that happen. All of this information that's coming out, both through their rather focused studies on Kesterson through the LBL people and the much broader studies that we've been doing, is that there isn't any simple answer to this drainage problem.

We published a report late last fall that we made copies available to you that is a summary of what we've done and what we think we know and what we think the options are for the future. It's been observed that the one thing that's clear to all of us now is that we have to do a better job of on-farm irrigation management and I think the farmers agree with that. They've been

very cooperative in starting to take those steps that are eventually going to reduce the amount of water coming off the fields by some number, maybe a half, and I think all of us agree, the farmers, the technical people, the policy people, the environmentalists, that the very first line of defense on this problem is to use less water in irrigation, but even that isn't simple. That isn't just a case of telling people to do it. You know, you're talking about changing extensively the practices and a lot of refinement, a year-by-year thing. It isn't something that's going to happen just by board order.

We list in here 8 or 10 different things that are going to be part of the future program. It's clear there is not going to be a single overall solution of the the drainage problem. There isn't going to be a drain out of that area for the foreseeable future, nor is there going to be a single answer to the whole problem. It's becoming apparent that you can treat the west side as five almost separable areas, of course, not completely because the river does tie a part of it together, but geographically there are five somewhat distinguishable areas there, and the solution is going to evolve somewhat uniquely for each one of those areas. The grasslands area you've just been talking about is one of those areas.

As we have started to look ahead now, we're about two years away from the end of the federal funding on this study, about two and a half years, two more complete budget years, and so we're starting to come to grips with what is the endpoint of this effort and where we're going to go. It looks less and less

like we're going to have a single drainage solution. It's going to be a whole series of things, of related activities, but it will vary from area to area.

One of the specific things that is going on now, it's clear it's going to go on in the future, at least for a generation, evaporation ponds. There are about 7,000 acres of evaporation ponds in the valley now. There are applications for more, but there is, of course, the concern that evaporation ponds could turn into another so-called Kesterson, and there is now more and more study being focused on the question: Is there a way to construct an environmentally benign evaporation pond? There are various theories under which it can be done. In the short term, I think, we will have to spend a great deal of effort on this. It's clear that evaporation ponds are part of the answer but that they, themselves, can create problems and we've got to figure out a better way to do them than we've done historically.

Treatment, and I use that in the sense of making the bugs or plants eat it, or running it through desalting plants, that kind of thing, overall does not look as promising as it looked two or three years ago when the Binnie & Partners proposals were really getting intensively underway on that type of thing. The volatilization proposal does continue to look like it's promising, and we're trying to figure out ways to get more money into that type of research, but the hope of several years ago, that somehow there would be a plant, some type of process, by which we could just run this drainage water through and the

bad stuff would come out, I'd have to say looks less promising now than it did a few years ago.

CHAIRMAN COSTA: How, if at all, have the state's participation in leading to these conclusions helped, either from the funds that we've put in a couple of years ago through the Department of Water Resources or any moneys that have been made available through the Prop 44 moneys, have they played any role in this?

MR. KENNEDY: The Prop 44 moneys really haven't come into it yet. The agencies are getting organized and the state board has to spend that money, but that's something down the road. I'm sure it will be helpful but it really hasn't been a factor yet, but the money that the legislature has provided to us, both the department and the state board, has been very closely coordinated with the federal money. I think one of the more positive aspects of this whole thing has been the coordination among all of the agencies involved so that there hasn't been duplicatory studies going on, and we and the state board have, I think, used that money very effectively to do the research that's been done.

Our staff and the other staffs have been working on a report, I don't know if you've seen it yet or not, Mr. Chairman, but Mr. Reeb has been overseeing the preparation of some studies as to what it is that we need to do on evaporation ponds, how much money is needed for studies, what are the priorities, and all of the research-related evaporation ponds, and it has been a very useful exercise for us to go through. It's now about to the

point where we've got to start making some choices and figuring out exactly where does the money come from for each one of these pieces of the research.

CHAIRMAN COSTA: Please go ahead.

MR. KENNEDY: One other part of the long term answer to some areas, and I think this is going to be very limited but probably basis locally, is taking some of the land out of production. We have talked over the last two or three years about the hot spots of selenium. The U.S. Geological Survey has identified that there are some areas where there are particularly high selenium levels, and we are now starting to at least discuss if there is some way to put together an institutional program that those lands can be put into some other type of use, other than irrigation, some other public use, and what are the economically ways to do this, and we're really just getting started on that. We're trying to find models that have been used in other federal programs where land has been taken out of production. I don't really see this as a large scale activity so much as focused on the particular areas that are causing the worst problem, but even that isn't going to be easy. We're going to have to...

CHAIRMAN COSTA: Yes, Mr. Jones for a comment or question?

ASSEMBLYMAN JONES: No, I think one of the things that the people miss in this discussion, Mr. Kennedy and Mr. Houston, that while we have this great deal of cooperation, you know, the fact of the matter is that water runs downhill, and I know there

have been some differences of opinion on that over the years, but it's been proven, and I think the question here is that originally when the Central Valley Project came in, there was a lot of farming already and the reason for the need to solve the drainage problem we continually talk about, we have to keep the land in production, which is an important part of it, but we also have to bear in mind that you can't bring more water into the bathtub without it eventually running over the sides, so the argument has always been on this, either selenium hotspots or keeping land in production, but the real issue is if you continue to bring in more water, eventually the bottom of the bathtub fills up no matter what, and it impacts on people that were not originally supposed to be impacted on, whether they be cities or communities. I know your Los Banos Grandes project, you've got considerable people concerned about that problem there, because you're going to put that water up above them and you're not telling how they're going to drain it.

I question, if the original project would have been able to go down the west side, if it had been made clear from the outset that the drainage problems were going to be dealt with up front, it wouldn't have happened, because that was part of the discussions, as you are aware, back in those years. So all I'm saying is that the issues that you raise are eventually going to cause a problem from a standpoint of not just the farmers, but the communities, but any type of water just because over a period of time the pressure's building with the rising water tables and the problem of doing anything more down there in relationship to

adding more water. We're just now starting to see the ramifications of the water we added over the last 15 years. With the basic assumption that the water runs downhill, eventually the Bureau's going to have a problem because they committed to drain the water originally. The state and everybody said we'd get that done. It hasn't been done, and so the problem isn't going to be just with the grower that's growing the crop. The problem is going to be with everybody that was around in the immediate area originally when the original water was brought in, and it's a much larger problem, and that is a real vexing problem, but it's going to impact all the agreements, the original agreements when you start talking about the quality of water in the San Joaquin River. Mr. Costa and I have discussed it quite extensively and the old exchange agreements and what have you, it all goes back to a quality question, so you've got the quality and you've got the quantity. In our case, we've got a problem with the quantity because it's increasing the pressure on everybody, not just the farmers that happen to be farming, particularly, in Westlands, but even in the surrounding areas, and I think that is going to add pressure to the process, so it's larger than just the people that have been involved historically.

MR. KENNEDY: I think you illustrate very well that..., we hate to say problems are complex because it sounds gratuitous, but this is really a very complex problem and I think it's ultimately got to be solved through a lot of negotiation over a number of years as to what is the best way to deal with it.

There's hope that somehow the board could just order somebody to do something and the problems, a very tough technical problem, is going to get solved and maybe that's what we've all been disabused of. When I hear this discussion about there being other environmental priorities, Mr. Costa, I can add quite a few to your list and I think Mr. Houston has really been very forward in trying to deal with the CVP's historical problems. One of the large ones is the temperature control up at Shasta. That's going to eventually have to be done. It's going to be very expensive. It's an environmental issue. I think before we put a lot of money into something we don't understand, as Mr. Chapin just said from a waterfowl standpoint, in his judgement, Kesterson isn't that big a deal. Now that's not to say, I don't know enough about it to make that statement. I'm interested to hear him say that. Well, the temperature control problem coming out of Shasta is a big deal. The Red Bluff diversion dam is a big deal. These are expensive problems, and I would be very reluctant for Congress to get the idea that we've only got one more big issue that we've got to throw some money at. We're going to have to go back there for a number of years and ask for money for California. I think this has all got to be put in a context of all the expenditures, as you indicate.

CHAIRMAN COSTA: Well, that's what we try to do sometimes, and we get accused of a lot of different things for doing that, but I couldn't agree with you in any stronger terms. Finally, Mr. Kennedy, because we have one more witness and this has taken some time, I don't know if you feel comfortable or not

in making any off the cuff statements, but based upon the information you've heard here today, do you think that there's a better way under which we can deal with the problem at Kesterson that is environmentally sound and maybe less costly than the current order?

MR. KENNEDY: I truly don't know. I'm not qualified to make that judgement. I sat through a very long meeting at about the same time that board order came out, where the LBL scientists and the Fish and Wildlife scientists debated this whole issue before a panel of the National Academy of Sciences, and I think we had 16 scientists from outside the area with no ax to grind listening to all these other scientists debate this issue, and what I got out of it was that this is very complex and that lay people ought to be a little careful of making these scientific judgements about it. Now, the one judgement I'm happy to make is that I think when public moneys are spent there should be some expectation of what that benefit is. I'm very troubled by this notion that we should just throw money and hope this thing's going to go away knowing that there are so many other needs out there that we have to fund. I really can't go along with this. Maybe it is going to eventually cost more money to clean this up, as Mr. Candee said, but I think that money ought to be spent after a lot of deliberation. This rather simple statement is made: well, the Bureau's obligated to do this legally. Our department has been through years of litigation about what the Bureau as obligated to do. I don't think anybody has got any more experience with disputes with the Bureau of Reclamation than

we do, but at the same time, you can't order the Congress to spend this money. You can order the Bureau to do it but the Bureau doesn't have the money themselves, and I think it's just simplistic to pretend that somehow this is a simple jurisdictional issue. The Bureau's in a tough position, and I think they're probably doing the responsible thing when they're told by the Congress the money may not be there, to say wait a minute, let's all pause and reflect about where we're going with this thing.

CHAIRMAN COSTA: So, in your opinion, further study on this would be acceptable, given the environmental downsides, to get a better handle on how we ultimately resolve it?

MR. KENNEDY: It certainly strikes me..., one more difficulty: on the one hand you've got the University of California scientists saying one thing. Now I hope that my alma mater doesn't distort my thinking too much, but these are not just Bureau of Reclamation scientists. They're from a respected university and they have an opinion. You've got some environmental scientists on the other side. In my mind, that puts the rest of us in a position of having to go a little bit slow until we do have a better understanding of what are the facts on this thing. I have been troubled all along by the notion that the university scientists could simply be brushed aside. They've done a great deal of work. I felt, again, Mr. Houston doesn't need me to defend him, but I felt that by going to the university and giving them money to study this and try to come up with some facts, I felt that was a very constructive

thing to do at the time, and I think it's unfortunate that it eventually became kind of a whipping boy. I continue to have some confidence that if the university says, "here are some facts," that if all the rest of us don't understand it scientifically we ought to at least pay a little bit of attention to them, particularly when it comes to spending public money.

CHAIRMAN COSTA: I think it ought to also have some credibility as well.

MR. KENNEDY: Well, it certainly does in my mind, as I say, but I'm not completely dispassionate on that issue.

CHAIRMAN COSTA: All right. Thank you very much.

Our last witness is Dr. Ulrich Karlson. He's waited very patiently. He's come from the University of California, Riverside, and has a little slide presentation, and when this is concluded we will be finished.

We appreciate your coming this distance, Dr. Karlson.

DR. ULRICH KARLSON: No problem. Thank you very much for the invitation to speak to you today and to those of you who held out, thank you very much for staying.

There will be more science. I put a little handout together. If I throw the slides up there, are you going to be able to see them? I put this handout together so that those of you who are here and those members of the committee who are not here today can catch up on the data part that's on the slides.

There was talk a little earlier on how isolated is this problem. Well, this is from an EPA list on where are selenium high risk sites, and when I look at this list to date it's

already slightly outdated. One place that's not on there are the evaporation ponds at the Peck Ranch where there's a clean up order pending. Just as an example.

To get selenium into a global perspective, what happens with selenium on the global scale, there's an important part that is to be known about selenium that selenium goes through a geological cycle and the atmospheric part of that cycle closes an important loop, so this is on a global scale, and what this diagram shows you..., this was done by the Swedish EPA, is that as (inaudible), and that's shown on the right with that little arrow going up, and the photogenic emissions contribute selenium into the atmosphere and that selenium returns eventually in the rainfall as selenious acid. So, selenium is being distributed in the atmosphere on a global scale all the time.

Now, what are the magnitudes of this happening? What these numbers, this is, again, the Swedish EPA that made this estimate, what this tells us approximately that on a global scale only in the northern hemisphere, there is anywhere between 5,000 and 10,000 tons of selenium cycled through the atmosphere, so six tons of selenium that we find accumulated at the Kesterson reservoir, is tiny amount compared to the amount of selenium that's flying through the air.

Here at Kesterson, where we find the selenium concentrated is not, as we originally thought, just in the top six inches but quite a bit further down. This is one measurement that we took on one of our research plots. The good part about most of it..., most of the selenium being close to the surface

has an implication on our proposed method of volatilization because, and I'll show you some more data on that in a few minutes, what we found out is that volatilization depends on the selenium being in the vicinity of the surface. In other words, if we were to scrape up the Kesterson sediments and put them into a large pile, in order to go back later to that pile and do the volatilization technique on that, we would have to spread it back out. Right now, the way the selenium is in the sediments at Kesterson, I would call that almost ideal for the requirements of the microbial treatment.

What are the contributors to this volatilization from soil? Most of them are fungi. There's diversity of fungi out in the soils, in particular in the soils on the west side that have already seen selenium. These are just a few examples of different isolates that we got from those soils, and the procedure that we are proposing, we do not plan to add any of those fungi to Kesterson or any other soil where we would treat the soil, because the fungi already are there at this specific site. Those microorganisms that are living right at the place, we expect to be the most adapted to the situation, and these are the kind of organisms that are doing it.

Now, in our research on selenium volatilization, we went in two phases. The first phase was in the laboratory, and for mere experimental ease, instead of taking a soil that's already contaminated, like the soil at Kesterson, we used a soil from the vicinity, here, as for example, the Los Banos soil, and contaminated ourselves. The reason why we preferred that is it's

analytically more easy to do it that way. We can label the selenium and thereby get correct results. Basically it's the same biological process.

So what we observed is, if you can see these bars there, that is, if we would just make a soil like the Los Banos soil which is from a seleniferous area, if we just make it moist, that would be the control, then it volatilizes at a certain rate every day there's so much selenium coming off. Then, if we add certain compounds, those quantities of selenium that are coming off increase, depending on what we add. So there's manure or straw or then, in the next slide, we would add some defined compounds like cellulose or pectin. But all these have in common is that they are food for the microorganisms. We call them a carbon addition or a carbon amendment. It is essentially carbonaceous material that the microorganisms use as a source of energy.

In this laboratory stage of research, what we found is most efficient in stimulating the microbial volatilization is a compound in pectin and that compound is identical with the pectin that you would buy in a grocery store to use for canning. If, in addition to the pectin, we can use certain metal activators: cobalt or zinc or nickel, and the choice for field application would be zinc in the form of zinc fertilizer, then we get an additional stimulation of this activity.

So, if then we let this kind of experimentation run over a longer period, in this case almost four months, then depending on the level of selenium that is is the soil, but you see it's fairly broad across, a very low level of selenium contamination

up to a very high, but the essential amount of selenium coming off just in these few months, and you see the range there achievable with this soil, there was between 25 and 45 percent. This was adding selenate. Selenium is in the soil in the form of selenate and selenite. Selenite produces even slightly higher removal rates.

I mentioned to you pectin, we found is a very good substrate to use. If we look at this list of different agricultural wastes and plant materials, then we see they have a different content of pectin in them. The one that sticks out by far is the citrus peel with thirty to thirty-five percent of pectin, and you will see in the field we did find that connection there. A few other considerations about what do we need to do to stimulate microbial activity to produce volatilization, how about the moisture content? Well, we have heard a lot about dry versus moist today. If we keep the soil real dry, as you can see from this nonexisting bar on the very left, you can forget what's coming off. Then, if we keep the soil and the field moist, as approximately the moisture content of a sponge if you squeeze it out, that equivalent to a soil situation, we get the highest volatilization rate. Then, if we overdo the watering, turn the soil into a soil-water slurry, as it would be similar to flooding the soil, then the rates go down very rapidly again. So moisture is critical.

Another factor that is critical for this process is temperature. What you see there, lined up, the steeper the line is the faster the selenium is coming off, so we have six lines

because we ran this experiment with Kesterson soil. The highest temperature is the highest rate coming off. The lowest temperature is the lowest line. So, with increasing temperature, the efficiency of the process increases. Expressed in Fahrenheit, it's approximately 20 degrees Fahrenheit increase in temperature, the rate of selenium volatilization approximately triples. So it's very critical, hence during the winter months we had some relatively low volatilization rates, and we can for that reason not yet make a prediction on what we can achieve during a summer period.

Now, going out in the field, we used a list of agricultural wastes to stimulate volatilization at the experimental site at Kesterson and also at the Peck Ranch, and the list comprises citrus peel and cattle manure and straw and grape pulp. We tried some molasses and some natural vegetation, and then fertilizers; zinc sulfate as a stimulator and also some nitrogen to go with the straw. These applications were laid out in this kind of a set up, 12-foot plots, and you can see there citrus peel and manure and straw, and after all these were all spread out and in some cases fertilizer added, this is rototilled. This rototilling operation is repeated approximately once a week, so we keep that soil aerated and turned over very frequently to stimulate the microbial process. You could say we're farming for fungi.

And then irrigation has to be brought in, and what we have been doing is adding just enough water to keep the soil moist but not any significant quantities of water that would

start moving the selenium down. Now, on the expense side, the irrigation right now, and the estimates of how much this would cost is by far the biggest factor. The second biggest factor is the cost of trucking in those farm residues. The price for the materials itself is relatively cheap, but then the truck costs are quite substantial.

Just to explain to you, it's not easy to actually figure out selenium volatilization rates in the field. You have to come along with an inverted box, and a number of considerations comes into play in how this has to be designed and the selenium has to be trapped in a special trap and we have to carry out a generator and a vacuum pump into the field, but essentially what we do is go in the field and put these inverted boxes out there. This is a slide of our site at the Peck Ranch, and capture the selenium being volatilized from those soils and trap it in this bottle with a chemical and then the liquid trap gets transferred to the laboratory and analyzed. Just a few of the things that we have found: I mentioned to you temperature is critical so we wondered how does that work during the day. This is just the distribution of the temperature curve during the day, cold at night and warm in day, and the soil temperature, of course, goes with the same pattern. Now, very interestingly, the selenium volatilization rates follow this pattern with just a delay of a few hours. So, when we are doing our estimates now we are going in in the early afternoon to catch that peak and thereby make the comparison between treatments.

What does it look like between treatments out in the field? This is a measurement that was done in October. On the very left you see depicted how much selenium came off if you just keep the soil moist. What you see here, to just keep the soil moist and rototill it already stimulates the microbial process. But then these various treatments, to a different degree, stimulated the process quite essentially more and we're getting number to excess of 150 micrograms of selenium coming off an hour. When it got colder, then, in December, you can see that these numbers went down quite a bit. We have the same pattern here. Again, it's the citrus treatment that produces by far the strongest results. But because the temperature in December was lower the overall rates are lower.

Now, to sum up what we're doing, what we're trying to do is accelerate a natural biological process of detoxification by converting selenium into a gaseous form that escapes into the atmosphere and we rely in that on soil fungi to do that and what it requires is a carbon source, adequate moisture, adequate aeration and activators like zinc can help there.

CHAIRMAN COSTA: What you're describing here is what has been referred to as the Frankenburger study, is that correct?

DR. KARLSON: Yes.

In a diagram, what we're saying is take the selenium,...

CHAIRMAN COSTA: Although, as I see here on the left of this page, it's referred to as the Frankenburger-Karlson process. You haven't been getting adequate credit, Dr. Karlson. I've always heard it referred to as the Frankenburger study.

DR. KARLSON: Well, there are certain structures at the university, you know.

CHAIRMAN COSTA: I understand.

DR. KARLSON: So, to give an overall picture, what we're proposing is that the selenium that's in the soil be taken up by microbial organisms, which is happening anyhow but at a very slow rate, and that this process be stimulated by various numbers of treatments and thereby permanently eliminate the selenium from the site.

CHAIRMAN COSTA: Well, we appreciate that presentation. Is that the conclusion of it? I have a couple of quick questions. It's late, and we do want to conclude this. There was a mention of the wetflex that was talked about earlier, the entombment process, and now, as you heard today, this dryflex method. Based upon the research that you've done there, what, in your judgement is the best way to deal with the closure of Kesterson on those options.

DR. KARLSON: I would produce the dry method and then work towards a solution like that.

CHAIRMAN COSTA: A solution like that? But you said in its current state, right now, is the ideal time to implement that type of process, did you not? Or did I misunderstand you?

DR. KARLSON: Yes, what I'm referring to is where the selenium is concentrated in the top part of the sediments, it's the ideal setting to pursue a volatilization program.

CHAIRMAN COSTA: Oh, I see. It doesn't matter whether it's dry or whether it's got some moisture in it at this time?

DR. KARLSON: In order to get the process going it has to be moist but not wet.

CHAIRMAN COSTA: What do you think the cost of your process is there?

DR. KARLSON: I knew you were going to ask that, and I cannot at this time give an estimate to that.

CHAIRMAN COSTA: No ballpark figure?

DR. KARLSON: No, I'd rather not.

CHAIRMAN COSTA: How many years would it take to eliminate all the selenium?

DR. KARLSON: That's a part of the question that I cannot answer. That's why we're doing this research, to be able to give that estimate. Again, I wouldn't even want to guess what it would be. The guess would have to be on how many years, it has to be, and I don't have enough data to say that it's going to be one year or ten years. My personal feeling is that's going to be the range, anywhere between those two numbers, and I realize that is not a sufficient estimate with which you can be happy. I hope to know more after this season.

CHAIRMAN COSTA: In the dry state, do you believe, in the dryflex system that Kesterson is a significant harm to the environment?

DR. KARLSON: No, I don't think so.

CHAIRMAN COSTA: Mr. Jones for a question or comment.

ASSEMBLYMAN JONES: I've heard this approach discussed before, but this is the first time I've had it explained to me this carefully, and as a farmer, looking at what you're

proposing, I can't help, you know, you've got zinc, you've got manure, you've got peel, you've got light moisture and you've got mulch. It seems to me that you could go out there and plant a plant on a 36 or 40 inch bed and lightly sprinkle it, a shallow rooted plant, and be able to do what you're suggesting and at the same time grow a crop. Because you're not putting anything into that field that we don't put in all the time. You're putting in any tillage practice that we don't do all the time, and the light moisture, for a shallow rooted crop, for preliminary irrigation initially to give you a little moisture during the heat of the summer, keep the roots shallow, it looks to me like what you've got there is a normal biological process that in fact could be taken with some kind of crop, could be taken off in doing that. I realize that's speculation. What you're doing is scientific study. I'm just looking at it from a very utilitarian approach because this looks like all the elements that we do all the time in growing a crop.

DR. KARLSON: Yes. That sounds like a thought to look at. One thing I'd like to point out though is that while we're doing these things that farmers do too, we're doing them on a much more intensive scale. Like in this experimental stage we're rototilling once a week. That would be a little bit hard for growing plants unless we rototill in strips...

ASSEMBLYMAN JONES: I'm just thinking that, you know, realizing we've got other locations like this, realizing we've got to come up with something that works, not just here, not just in the lab, but works on a larger scale, and I think that's what

you're working toward, the applications of the way you're directing this isn't too far away from an application from a practical standpoint out in the field to bring some agricultural application and do both at the same time. I don't see too far a distance. It might adjust your volatilization a little bit at certain times. It might not be laboratory perfect and you might not get it done quite as quickly, but from a utilitarian standpoint and from a revenue generating standpoint, it seems that you could pull the two together and make something work.

DR. KARLSON: We would have to find a plant, though, that's going to take the selenium stress that we have in the Kesterson site. It's not just selenium, it's also highly saline.

ASSEMBLYMAN JONES: I appreciate that.

CHAIRMAN COSTA: All right, Mr. DuBois.

MR. DUBOIS: We need that salinity in order to enhance the volatilization. Is the salinity an essential practice?

DR. KARLSON: No, no, if we were to go without salinity it would work better. Salinity stresses the bugs, too. They can't handle it.

CHAIRMAN COSTA: All right, Mr. Chapin.

MR. CHAPIN: As the selenium concentrations in the soil are decreased by this process, does the rate of reduction remain the same?

DR. KARLSON: The rate stays the same as far as percent of the inventory being removed at any given time is concerned. But, of course, as the inventory goes down, the absolute amount coming off reduces so that the disappearance of the selenium from

the soil would not be linear, it would be curvilinear. It would start, as we approach target values it would proportionately get lower. It would still be the same in percentage of inventory removed.

CHAIRMAN COSTA: Thank you very much. I appreciate your time, Dr. Karlson. Mr. Jones, I certainly appreciate the time you've taken this afternoon, and those of you in the audience who have participated, I think this information has been very helpful and it will add to the dialogue, which is what it was intended to do as the board considers this issue next week and as we try to deal with this over the course of the next month. Thank you very much. This hearing is concluded.

APPENDICES

APPENDICES

Excerpts of remarks of David G. Houston, Regional Director, United States Bureau of Reclamation presented to California Assembly Committee on Water, Parks and Wildlife, May 19, 1988.

Mr. Chairman, members of the Committee, my name is David G. Houston. I currently serve as the Mid-Pacific Regional Director of the Bureau of Reclamation. Chairman Costa requested that I appear here today to represent the Department of the Interior and express our views on the status of clean-up at Kesterson Reservoir.

We appreciate the opportunity to share our views with you and are encouraged that this hearing will prove to be a forum where an open discussion of drainage issues in the San Joaquin Valley can take place. I'm hopeful that our participation, particularly our research related to alternative clean-up strategies at Kesterson, will assist this committee in its deliberations on actions or activities it wishes to pursue in addressing the drainage issue.

First, I would like to emphasize that the Department is committed to correcting the environmental problems at Kesterson. We have never questioned whether we have such an obligation but rather have focused our energy and resources toward developing an environmentally sensitive and cost effective strategy which protects public health and environmental values in the Kesterson area.

On March 19,1987, the State Water Resources Control Board (Board), in their Order No. WQ 87-3, directed the Bureau to proceed with the Onsite Disposal

Plan (ODP) which consisted of developing a containment facility capable of accommodating surface vegetation and contaminated soils excavated from the reservoir. On April 7, 1987, the Secretary announced that the Department would comply voluntarily with the Board's order. Despite our disagreement with the Board concerning the best cleanup approach, we have taken all the necessary steps to meet that commitment.

We pursued and received a supplemental appropriation in Fiscal Year 1987 and a budget amendment in Fiscal Year 1988. We completed the designs and specifications and proceeded to bid for the onsite disposal facility. And, consistent with the encouragement of the Board, we continued the research effort at Kesterson and have broadly shared the results of our research.

Recently, the Congressional Appropriation Subcommittees (Energy and Water Development; and Interior and Related Agencies) sent letters to the Secretary questioning the efficacy and cost of the cleanup approach approved by the Board and encouraged the Department to request reconsideration of the Board's order. These letters create an obstacle in that without assurance of the continued funding necessary to complete the post excavation management actions (cost estimates range from $13 to $100 million) it appears that environmental problems at Kesterson could be exacerbated rather than cured.

While preparing for onsite excavation and disposal activities in accordance with the State Board's Order our research at the Reservoir, for the purposes of guiding our planning of post-excavation management actions and

furthering our limited understanding of the geochemical and biological properties and behavior of selenium under various environmental conditions.

A significant finding from this research was that excavation pursuant to the approved onsite disposal plan will not, in and of itself, achieve a satisfactory level of wildlife protection at Kesterson Reservoir because a significant fraction of the residual selenium there exists in soluble form in the pore waters of the vadose zone (the zone between ground surface and the underlying water table), which extends to depths up to 10 feet or more. In contrast, the approved excavation plan calls for primary excavation only to depths of approximately 6 inches.

Related findings from our continuing research were: 1) that soluble selenium in the vadose zone does not pose a continuing, substantial risk of further ground water contamination because of geochemical processes that immobilize selenium in the ground water system; but 2) that the soluble selenium in the vadose zone is displaced towards the surface by rising ground water that can form ephemeral pools within Kesterson Reservoir, and that the concentrations of selenium in such ephemeral pools can equal or exceed the concentrations in the drainwater previously discharged into Kesterson Reservoir. Additionally, selenium concentrations in organisms (e.g., vegetation, insects, and mosquito fish) in ephemeral pools remain in the range of those measured when drainage water was still being discharged to Kesterson.

These findings are of special concern to us from the standpoint of wildlife protection because the presence of water in the Reservoir attracts a greater diversity of wildlife, and particularly water birds, and the

quality of any such water is obviously critical to the health of this wildlife.

Excavation under the approved cleanup plan cannot alone ensure protection of wildlife at Kesterson Reservoir because the existing plan does not address the concerns associated with the formation of ephemeral pools in Kesterson Reservoir after excavation. Indeed, the excavation as planned will increase the potential for the formation of ephemeral pools in Kesterson Reservoir by decreasing the distance between the ground surface and the water table.

The formation of ephemeral pools in Kesterson Reservoir can be minimized by a combination of appropriate grading and filling actions. The essential issue here is whether it is prudent to first excavate and thereby increase the necessary magnitude of such actions, in light of the expected costs of this sequence of actions.

At this juncture I would like to familiarize to Committee with some of our research findings with respect to the other strategies we have had under investigation and follow up with a brief overview of what we have recommended to the State Board.

Wet flex is a term coined to reflect a strategy we had previously presented to the Board as a component of a "Flexible Response Plan" we had encouraged the Board to adopt. Conceptually, it entails keeping the ponds wet with selenium free water and utilizing the natural properties of selenium in the environment to maintain it in a biologically unavailable form. A test facility was constructed in Pond 5 which has enabled experiments to verify

whether the hypothesis was valid. The research has demonstrated that within 6 months the concentrations of selenium in Pond 5(e) surface water had dropped below the goal of 5 parts per billion (ppb) and have remained low for the past 18 months. The rest of Pond 5, which continued to receive higher selenium water after Pond 5(e) was constructed, is showing similar results but lags the results in Pond 5(e) by about a year.

By June, 1987 (one year after selenium free water was introduced to Pond 5(e)) the base food chain items had dropped from 50 to 60 parts per million(ppm) to 5 to 10 ppm. The concentrations rose in the autumn and in January, 1988 were in the 10 to 20 ppm range. Similar patterns were observed for invertebrates and mosquito fish (i.e., damselfly nymphs which are a common waterbird food) where concentrations in damselfly dropped from 98 ppm to 16 ppm then rose to 29 ppm in January, 1988. Overall, the decrease ranged from 46 to 94 percent in 18 months.

The autumn increases suggest some selenium recycling through microbial processes in the bottom sediments. Some of the selenium is volatilized some is taken up by plants and other food chain elements but most is recycled back to the sediments. The hypothesis is that most of the selenium will return to the sediments and over time be biologically unavailable. Early results for experiments this year tend to support this hypothesis. But, in view of the continued uncertainty over whether controlled flooding can be used effectively for environmental protection at Kesterson Reservoir, as I discuss later, we are now proposing basically a dry-management approach.

Microbial Volatilization has received much attention lately and we have been conducting experiments on its applicability at Kesterson. Research suggests that volatilization can accelerate and permanently deplete selenium in the Kesterson environment. Laboratory experiments suggest the potential for up to 50% depletion in 4 months with no lower threshold for how effective it can be. Field experiments were initiated last year and are still too preliminary to forecast absolute results but the preliminary measurements show a 50 times increase beyond background levels. These tests were initiated in October 1987, and since volatilization is temperature dependent, results this spring and summer would be expected to be higher.

There are uncertainties with the volatilization strategy including the intensive management required, air quality considerations, the requirement for a low salinity water supply, and the fact that alone it cannot address the ephemeral pool issue, but it does offer promise for permanently removing selenium from the site.

Our ground water research has also shed light on the site characteristics at Kesterson. Selenium does not appear to be a major problem for ground water contamination because the selenium is immobilized near the surface. While there are a limited number of exceptions where in the past the high concentrations of Nitrate appear to have overwhelmed the denitrifying bacteria in high infiltration rate areas, over 70 percent of the monitoring wells which had elevated levels now show declines and many are now below the 10 ppb level. Only 12 wells currently have levels above 10 ppb and most of those are showing declining values.

On the basis of this research we have concluded that the residual selenium at Kesterson Reservoir can be effectively controlled, in place, without excavation. We are proposing a course of management actions to the State Board for this purpose. An essential step in this course of action is to determine what may be the extent of ephemeral pools formed by rising ground water in the Reservoir under the circumstance where the influence of flooding of the Reservoir on the underlying ground water has been eliminated. We would then act to eliminate, or at least effectively minimize, the residual formation of the ephemeral pools that are so attractive and dangerous to wildlife.

Contemporaneously we would proceed to determine what combinations of controlled volatilization and associated cropping, tilling and other management actions can be most effective at permanently and safely dissipating selenium from Kesterson Reservoir. Scientific progress in our understanding of how selenium behaves in the environment, and how to best manage it, may have applicability throughout California and the west where selenium contamination problems exist.

By recommending this alternative course of action, we are by no means abandoning the basic goal of effective environmental protection at Kesterson Reservoir. Our view, however, is that we can achieve this goal at justifiable costs through the course of action we have recommended to the State Board.

Testimony of Land Preservation Association Regarding the Clean Up of Kesterson Reservoir by the U.S. Bureau of Reclamation

INTRODUCTION

Land Preservation Association is an organization composed of twelve water agencies serving over one million acres of farm land and wetlands in the western San Joaquin Valley. The subject of today's hearing is an issue of vital interest to LPA and its members for a number of reasons. Beyond the obvious interest that everyone shares in seeing Kesterson Reservoir cleaned up quickly, we also see that Kesterson Reservoir has become a strong symbol of the serious drainage problems facing much of the land we represent. Those drainage problems threaten farmers served by our members in their ability to produce crops as well as their ability to obtain financing to continue farming. It also threatens the wetlands since a valuable supply of water has been lost and has not yet been replaced. Indeed, the economic vitality of the entire area is at risk if drainage problems are not brought into focus and managed effectively. The way the Kesterson Reservoir problem is managed reflects on the ability to address the overall drainage problem.

Presented by Stephen K. Hall, Executive Director, Land Preservation Association before the California State Assembly Committee on Water, Parks and Wildlife, May 19, 1988, Sacramento, California

CURRENT STATUS

A little over one year ago the State Water Resources Control Board ordered the Bureau of Reclamation to cleanup Kesterson Reservoir. Today the Bureau is poised to begin, but in the process of preparing the cleanup it has discovered some problems with the chosen method, known as on-site disposal. So the Bureau has asked for a re-hearing by the State Water Resources Control Board to consider the on-site disposal plan as well as alternate cleanup and management plans that are currently being researched.

In the interval since cleanup was first ordered a great deal of knowledge has been gained about Kesterson Reservoir, as well as about selenium and the way it acts in the environment. There have been some encouraging research results that show real promise and that have given us good information. Among these are the volatilization experiments conducted by Dr. Frankenberger of U.C. Riverside. Other useful information has been developed by the Lawrence Berkeley Laboratory research that has shown selenium is not nearly as mobile in groundwater environments as once thought. That information is important because it provides a great deal more flexibility in the way Kesterson Reservoir is cleaned up and will also help shape long-range drainage solutions. On the other hand, there are some things that have not worked. Hazing, for instance, has not been successful; at least not for those birds that are at greatest risk, such as coots and shore birds.

Unfortunately, although there are more facts, there does not seem to be a consensus about what they mean. There are a couple of reasons for this. First is the sheer complexity of the situation faced at Kesterson Reservoir. The fact is, while there is some good information, there does not appear to be a sure-fire way to cleanup Kesterson Reservoir in a time frame that is acceptable to all interested parties. Even more unfortunate, the facts gained seem to have even further polarized viewpoints of those involved. It now seems as if scientists that once shared information can't reach a common understanding when they look at the same set of facts, and indeed some don't even trust the data that is developed.

From our standpoint, the issues surrounding Kesterson Reservoir are troubling, not only because there isn't agreement on the facts or what they mean but because the dispute over Kesterson Reservoir distracts from other important drainage issues. To the extent Kesterson Reservoir remains the focus of the discussion it dominates the entire drainage issue and makes it even harder to reach agreement on ways to manage the overall drainage problems facing California. It must be remembered that those drainage problems will continue long after Kesterson Reservoir is cleaned up.

LPA'S POSITION ON CLEANUP

Because of the ongoing problems at Kesterson Reservoir and

because of the need to move on to addressing longer range drainage problems, LPA strongly supports an immediate cleanup of Kesterson Reservoir. I want to emphasize that we not only want it cleaned up soon, we want it cleaned up in a way that makes sense environmentally and economically. LPA is not a scientific or research organization. We do not have the resources to devote to developing a cleanup plan for Kesterson Reservoir. We do, however, believe that the cleanup of Kesterson Reservoir must be based on good science. Whether the proposal put forth by the Bureau of Reclamation is scientifically sound, we leave to those who are properly trained to judge. But in our opinion there have been some significant scientific accomplishments in the past year. Wildlife impacts have declined. The cleanup method proposed by the Bureau, known as wetflex, has not proven itself conclusively but has given us some valuable information on which to base cleanup decisions. Cleanup methods such as volatilization, while introduced too late to receive initial review, now look promising enough to warrant serious consideration. Perhaps one of the most encouraging developments is a fairly simple proposal being discussed that calls for the reservoir site to be dried out and managed in a way to eliminate or greatly reduce use by waterfowl or other wildlife. While this in itself is not a cleanup, it could render the site environmentally benign until a cleanup method is chosen and carried out. LPA could support such a proposal so long as it calls for a specific time line for selection and completion of an

effective cleanup plan. The importance and precedent setting nature of this issue demand that we take the time to develop a cleanup plan that is sensible, not just expedient.

LPA PROPOSAL

One of the concerns expressed over taking the time to develop alternate cleanup methods has been the threat of continued impacts to wildlife unless Kesterson Reservoir site is cleaned up immediately. We share that concern and recently proposed a plan that would help alleviate environmental problems should they persist. The proposal involves developing wetlands nearby or adjacent to Kesterson Reservoir. The wetlands would be permanent and would include a water supply sufficient to make them viable as wetlands. More recently, we have improved that recommendation by suggesting that instead of developing additional wetlands we simply provide adequate water supplies for the wetlands in the Grasslands area. Although our proposal was not fully developed because we could not gain sufficient support, we continue to believe that if the State Water Resources Control Board chooses to allow more time for cleanup to be carried out, our proposal could be an effective way to minimize environmental risks. In that light, we want to renew our expression of support for such a concept and restate our willingness to work with others in developing such a plan.

CONCLUSION

LPA wants to see innovative new approaches used both on the scientific level and in policy. Though we cannot contribute directly to the technical issues surrounding Kesterson, we are willing to work toward developing policies that encourage the development and implementation of the best technology available in addressing the cleanup of Kesterson Reservoir. Toward that end we want to urge that cleanup proposals be judged on their scientific merit rather than on political considerations. If the Bureau of Reclamation can present a good technical case for cleanup methods other than on-site disposal, which we know to have problems, then those methods should be given time to work. LPA for its part can and will work with others in developing cooperative programs, such as our proposed alternate habitat idea, to assure that environmental impacts are minimized and that cleanup proceeds as soon as a good plan can be developed. We recognize that drainage problems, like all important resource problems, cannot be solved once and left behind but must be managed on a continuing basis. We are committed to preserving the land by effectively managing it, not abandoning it. We know that effective management includes resolving issues such as this drainage problem while protecting the other components of the valley's environment. We intend to be in that business for many years to come.

STATEMENT OF CALIFORNIA FARM BUREAU FEDERATION
TO ASSEMBLY WATER, PARKS AND WILDLIFE COMMITTEE
ON KESTERSON CLEANUP PLAN
MAY 19, 1988

My name is William I. DuBois. I am Director of Natural Resources for the California Farm Bureau Federation.

We are very concerned that agricultural irrigation drainage has been found to be in conflict with wildlife in the San Joaquin Valley. It is our conviction that if the master drain had been completed, drain water would not have been concentrated by evaporation at Kesterson, and that none of the present conflict would have occurred.

The drain was not completed, however, and tile lines essential to the agricultural area upstream of Kesterson were installed. Because the drainage water could not be disposed of to the ocean, the construction of an evaporation sump was required. It was not foreseen that the concentration by evaporation for such a short time would be detrimental to wildlife.

We believe the most productive solution to the present problem is to complete the drain to the western delta, entering the delta downstream of any point of extraction of domestic water. We are aware that it is not realistic to expect this to happen until there is general confidence that the benefits would outweigh the possibilities of environmental costs. Other provisions must therefore be made for accommodating the drainage, or agriculture in the service area will quickly decline. This places great urgency on the development and approval of affordable methods of treating agricultural drainage so that salts may again be disposed of to the ocean or salt sinks.

Of course there are other drainage areas in the state that do not have natural access to the ocean, but are now suspected of selenium problems. These other sites further emphasize the importance of holding in abeyance any final State Water Resources Control Board clean-up order on Kesterson until research efforts clearly point out the best practical way to treat the contaminated land and water. The issue is not just Kesterson, and it's not just the Bureau of Reclamation. It is not the Westlands Water District. The issue is how to deal with a by-product of irrigated agriculture that we didn't even anticipate until about five years ago. It is an issue that may affect several parts of the state.

About two years ago the State Water Resources Control Board found it necessary to require the Bureau of Reclamation to minimize the danger to wildlife cause by selenium. The urgency caused the board, a year ago, to act on the basis of less than full knowledge of the results of the various courses of action available. to them at that time.

We are not now criticizing the board for having chosen the on-site disposal option. The Bureau of Reclamation, however, while preparing to comply with the board's order, encouraged continued research on other

methods of clean-up, during the interim. It appears to us that this research has now produced facts which need to be reviewed by the board, before the bureau begins to excavate ground surface, and begins a process which may itself produce unanticipated hazardous results by uncovering additional problems.

If there is anything we do not need at Kesterson it is a man-made mountain of contaminated earth creating a physical monument to society's tendency to deal with scientific matters in a political manner before the scientists have time to evaluate the solutions. The environmentalists could plant a flag with a skull and crossbones on the top of Mount Kesterson. It would out-do James Watt as a membership tool for the Sierra Club. Each year the argument over the federal budget for monitoring expenses would remind everyone how dangerous it is to allow irrigation projects to exist. And no one knows what to do with the dirt pile in order to actually neutralize the issue. It also appears that moving the top-soil off of the ponds might ~~also~~ expose a worse problem at the underlying surface.

The Bureau of Reclamation has requested a rehearing of the clean-up order. We know the bureau did not request this rehearing without most serious thought. We urged them to request a rehearing much earlier, but we believe they were in a dilemma caused by their earlier pledge to comply with the year-old order, together with their realization that, most likely, if the board knew a year ago what is known now, the board would not have adopted the present order.

We believe that even if the board reviews up-to-date research results, but for some reason still believes it must enforce its year old order, this hearing is worthwhile. The board has ordered the bureau into an uncharted course that may be much more expensive than anticipated. Because of that danger, it is essential that the board has the advantage of all possible information to assure the validity of their action. As a result of rehearing the order, the scientists have been allowed additional time towards completion of their field work which will help them predict the rate of success in clean-up by other methods.

We think it is important for the board to bring a sense of perspective comparison to the issue of bird hazard. The chief danger seems to have been that a few coots have been lost during the last year, and maybe some blackbirds. The only thing we knew about coots was that they shoot them to protect San Francisco golf courses. Blackbirds we know lots about, and very few grain farmers or fruit growers are going to shed tears over the prospects of a decrease in blackbird population.

Is that why the government is rushing us into spending millions of dollars prior to the completion of research, to save coots and blackbirds? If so, we think the priorities should be reexamined. That might be an appropriate subject for your committee to consider.

We concur with and endorse the bureau's request for next week's hearing. We are pleased that the board has agreed to consider the latest information, facts, and opinions of the institutions and the

individuals who have continued their research for the 12 months since the board's action.

As the board considers its options, we believe it is important for them to consider that Congress may not be committed to spending unlimited funds on this issue. Four congressional appropriations committee leaders have made that very clear to the Secretary of Interior during the last couple of months. Other irrigated areas may be even less able to bear the local share of costs of clean-up than Westlands Water District landowners are, if selenium or other rare elements become problems to them and their districts. We believe it is far better that the board allow the facts to be developed to the board's complete satisfaction, before demanding that any course of action be taken on Kesterson. What the board orders may become a precedent for other areas, and few farmers or non-farming taxpayers want the state to risk proceeding on the wrong path, when a little more time might have put them on a much better path.

We are not satisfied that enough was known about the issue of selenium treatment to warrant the board's order of a specific course of action a year ago. We would not be surprised if that condition still prevails, but it appears more information exists now which must be evaluated. We are therefore pleased the Kesterson clean-up matter is being reviewed.

We appreciate the Water, Parks and Wildlife Committee giving this matter its attention today. We believe the committee is destined to become much more aware of many aspects of irrigation drainage in the near future; and we are anxious to work with you in that endeavor.

Natural Resources
Defense Council

90 New Montgomery
San Francisco, CA 94105
415 777-0220

TESTIMONY

OF THE

NATURAL RESOURCES DEFENSE COUNCIL

BEFORE THE

ASSEMBLY COMMITTEE ON WATER, PARKS AND WILDLIFE

MAY 19, 1988

Thank you, Mr. Chairman. My name is Hamilton Candee, and I am a Senior Project Attorney in the Western Office of the Natural Resources Defense Council (NRDC). With me today is Laura King, one of NRDC's Senior Staff Scientists. NRDC is a national environmental organization with over 17,000 members in California and over 75,000 nationwide. As you know, we have been directly involved with the Kesterson issue for many years. We appreciate the opportunity to testify before this Committee and to share with you some of our concerns about the current progress of the cleanup at the contaminated Kesterson Refuge. First, however, I would like to highlight some key recent history about Kesterson.

In the State Water Resources Control Board's original 1985 cleanup order on Kesterson, the Board found that serious problems had occurred at Kesterson ever since 1981. Beginning with the sudden disappearance of most of the different types of fish that had been present at Kesterson, and ultimately including widespread deaths and deformities of waterfowl and threats to other wildlife, this National Wildlife Refuge quickly became a toxic death trap due to the discharge of agricultural drainage.

New York Office:
122 East 42nd Street
New York, New York 10168
212 949-0049

Washington Office:
1350 New York Ave., N.W.
Washington, DC 20005
202 783-7800

New England Office:
850 Boston Post Road
Sudbury, MA 01776
617 443-6300

Toxic Substances
Information Line:
USA: 1-800 648-NRDC
NYS: 212 687-6862

Yet, it was not until June of 1986 that the Bureau of Reclamation terminated drainage into Kesterson. And, today, on May 19, 1988, the Bureau still has not begun the actual cleanup of this hazardous site nor provided a specific, definite plan for mitigation of the lost wildlife habitat.

During this seven year period, we have seen a number of significant developments. First, the Central Valley Regional Water Board refused to take any action at all when the Kesterson problems were first brought to its attention in 1984. On appeal, the State Board held hearings at which the U.S. Bureau of Reclamation urged the Board to take no enforcement action, on the theory that the Bureau could take care of the problem itself. (In fact, in its closing brief to the Board, the Bureau claimed that the Board's proposed cleanup order would cost over several hundred million dollars, that all wildlife impacts could be eliminated by the Bureau's own management strategies, and that there would be no significant environmental harm in waiting another 5 years for further scientific study. Of course, we now know all of those claims to have been erroneous.)

In its key 1985 order, the Board found that Kesterson was a hazardous waste site that threatened drinking water supplies and the public health. The Board wisely rejected the Bureau's plea for endless delay and unanimously ordered the closure and cleanup of Kesterson by February 1988.

In 1986, after finally terminating drainage into Keterson, the Bureau proposed an experimental "cleanup plan" to the State

Board that would simply flood the Reservoir rather than remove its toxic contaminants. The Bureau hoped that its "phased approach" would buy it more time for further study, while also delaying any serious cleanup. In a candid description of its cleanup goals, the Bureau's Secretarial Issue Document revealed that the goal of all the Bureau alternatives was to retain Kesterson's availability as a disposal facility for agricultural drainage.

Once again, the Board rejected the Bureau's request for further delay and ordered completion of a traditional cleanup by August 1988. The chosen method was the Bureau's own alternative proposal known as the onsite disposal method. Although the Bureau never challenged that order, and indeed even promised to comply "voluntarily", and even though Congress has appropriated over $20 million for the task for this fiscal year, the Bureau has once again sought a delay. In a new stack of documents just released this Monday --i.e. only three months before the Board's August 1988 deadline -- the Bureau has now proposed a new alternative strategy that involves further study and further delay, yet no cleanup.

Since the Bureau's new proposal will be the subject of full evidentiary hearings next week, we will not attempt to argue the technical merits of this latest proposal to this Committee. However, we believe the Bureau's consistent pattern of resisting a full cleanup, while always proclaiming its voluntary compliance, must be kept in mind. In addition, there is an

accompanying pattern involving the Bureau's approach to the State's jurisdiction that we believe deserves this Committee's consideration.

When this Committee held joint hearings with the Senate concerning Kesterson on November 16, 1984, Mr. Houston of the Bureau assured the Committee that the Bureau was working from an assumption that "we are under full jurisdiction of the State." Transcript at 57. His view was immediately confirmed by the Interior Department's Regional Solicitor, who advised the Committee that the normal rules of federal preemption did not apply to Kesterson. Transcript at 58. This view has now been reaffirmed by both the State and Regional Water Boards in their Kesterson orders, and of course is explicit in the federal Clean Water Act. Yet, the Bureau has now changed its tune. Now that the Boards have handed down direct orders to cleanup the refuge and to provide full mitigation (including land and water for habitat), the Department of the Interior has backed off into a claim of federal sovereign immunity.

Thus, for example, all of the recent statements by Interior about compliance with the State's Kesterson orders have emphasized that the Department is only doing so because of its voluntary choice to work within the State Board's framework. More significantly, with respect to mitigation, the Interior Department has said flatly that "the Regional Board lacks authority to require the Department to undertake mitigation actions in connection with either its past operation or planned

closure and post-closure maintenance of Kesterson Reservoir." Brief of the U.S. Department of the Interior to Regional Water Quality Control Board, July 6, 1987, at 1-2.

In our view, the Department is clearly wrong on this issue and we are pleased that the Regional Board has agreed with our analysis and ordered the Department to provide full mitigation at Kesterson. However, despite a January 1988 deadline for providing a full mitigation plan, the Bureau now claims it needs until August to decide what mitigation actions it will actually take. Moreover, the Bureau has repeatedly announced that it may not comply with the Board's final order on this matter and refuses to recognize the Board's jurisdiction. We believe the state must keep this attitude in mind, particularly since the Bureau has just petitioned the state to allow it to expand its "place of use" (i.e. service area) by four million acres and so that it can sell an additional one million acre feet of federal water around the state. In light of the numerous environmental problems associated with Bureau projects, not least the drainage problems of its customers, we believe there must be a full commitment by the Bureau to compliance with state requirements for environmental mitigation and protection.

Again, thank you for this opportunity to testify. We would be happy to answer any questions.

ENVIRONMENTAL DEFENSE FUND

Rockridge Market Hall
5655 College Avenue
Oakland, CA 94618
(415) 658-8008

May 20, 1988

Hon. Jim Costa
State Assembly
2111 State Capitol
Sacramento, CA 95814

Dear Assemblyman Costa:

I regret that I was unable to attend the informational hearing held by your committee regarding the cleanup of Kesterson Reservoir. I have, however, enclosed a copy of my written comments to the State Water Resources Control Board on this matter, and hope that these will prove useful to the committee.

Sincerely,

Terry Young /rmh

Terry P. Young, Ph.D.
Consulting Scientist

cc: Mr. Bob Reeb (w/encl.)

TFY:rmh

National Headquarters
257 Park Avenue South
New York, NY 10010
(212) 505-2100

1616 P Street, NW
Washington, DC 20036
(202) 387-3500

1405 Arapahoe Avenue
Boulder, CO 80302
(303) 440-4901

1108 East Main Street
Richmond, VA 23219
(804) 780-1297

128 East Hargett Street
Raleigh, NC 27601
(919) 821-7793

ENVIRONMENTAL DEFENSE FUND

Rockridge Market Hall
5655 College Avenue
Oakland, CA 94618
(415) 658-8008

TESTIMONY OF THE

ENVIRONMENTAL DEFENSE FUND

ON THE CLEAN-UP PLAN

FOR KESTERSON RESERVOIR

National Headquarters
257 Park Avenue South
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(212) 505-2100

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1405 Arapahoe Avenue
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Raleigh, NC 27601
(919) 821-7793

Terry F. Young, Ph.D.
May 19, 1988

TESTIMONY OF THE

ENVIRONMENTAL DEFENSE FUND

ON THE CLEAN-UP PLAN FOR KESTERSON RESERVOIR

Terry F. Young, Ph.D.
May 19, 1988

SUMMARY

The management plan proposed by the Bureau of Reclamation (Bureau) as a substitute for the clean-up plan previously ordered by the State Water Quality Control Board (Board) should be rejected. The proposed management plan consists simply of continued experiments coupled with extensive biocide applications to kill the remaining plants and animals. Several years of expensive experiments and "interim management" have already taken place and have not provided a method which is superior to the Onsite Disposal Plan ordered by the Board; there is no compelling reason to believe that two more years will provide a magic solution. Two more years of the "wait-and-see" approach will, however, result in further damage to wildlife and cost $14 million.

The Bureau claims that its proposal will provide "equivalent protection against water quality impairment" to the Onsite Disposal Plan. We dispute this assertion for the following reasons:

-- the Bureau has provided insufficient evidence to refute the advantages of proceeding with the Onsite Disposal Plan,

in part because it cannot derive any relationship between pore water selenium concentrations and the resulting selenium concentration in naturally-occurring ephemeral pools;

-- in the event that the Onsite Disposal Plan does not entirely achieve the clean-up goals, additional remedies can still be pursued;

-- the "wet-flex" or flooding technique has not been shown to be an effective method to reduce exposure of wildlife to selenium, will not solve the ephemeral pool problem in the northern ponds, and actually has exacerbated the problem;

-- other potential methods to dilute the selenium into the surrounding air and/or water are still in the experimental stage; and

-- the proposed two-year management and research plan will not improve conditions at the reservoir.

Thus, proceeding with the Onsite Disposal Plan continues to be the option with the greatest chance of success in the near future.

Recent research results have, however, indicated that the Onsite Disposal Plan may not be sufficient to fully clean the site, and that follow-up measures will be required. We recommend that the Board consider requiring grading of the site after excavation and before the onset of the next rainy season to minimize the formation of ephemeral pools, and make the pool that does form easier to manage. Further, the long-term provision of alternate habitat should be required as an additional method of reducing any continuing exposure to wildlife.

The Bureau's apparent overriding concern with the cost of the Onsite Disposal Plan is misplaced. The post-excavation actions are highly unlikely to cost $100 million, which is the Bureau's worst-case estimate; reasonable

post-excavation actions are more likely to cost less than $10 million/year, as estimated by the Bureau for its 1990 "in lieu of ODP" plan.

DISADVANTAGES OF THE BUREAU'S "RECOMMENDED CLEANUP PLAN"

The "recommended cleanup plan" is actually a "wait-and-see" plan, combining the same stopgap measures to discourage wildlife use with continued experiments. The management actions that are proposed for the next two years do not represent any significant change from current conditions, and therefore cannot be considered "cleanup." The site will remain essentially unchanged, continue to be attractive to wildlife, and continue to provide contaminated food. The only significant change appears to be the addition of substantial quantities of biocides.

Many of these management actions are already included in the pre-Onsite Disposal Plan activities and should be continued, including:

-- dewatering;

-- hazing;

-- monitoring of uplands; and

-- alternative habitat water supply.

The management actions described as "vegetation management," including extensive biocide use, should be rejected by the Board even as interim measures; instead, physical knock-down and removal methods should be used prior to implementation of the Onsite Disposal Plan.

The experiments proposed for the next two years fall into two categories: those which should be undertaken following excavation; and those which are of questionable usefulness. In either case, there is no need to remain "on hold" for two more years awaiting the study results.

Among the experiments that are not justified are:

-- further evaluation of direct discharge into Mud Slough on the San Joaquin River (because of the recognized need to decrease current selenium loads in both reaches); and

-- further "wet-flex" or controlled flooding experiments (because the known disadvantages arguably already outweigh the potential benefits).

Among the experiments which should be undertaken following excavation (and post-excavation grading) are:

-- hydrological investigations to predict the extent of natural groundwater rise;

-- volatilization field trials and air quality analyses;

-- water treatment methods; and

-- cropping.

Several of these experiments are already funded by the San Joaquin Valley Drainage Program, and need not be considered an additional expense for reservoir operations.

SHORTCOMINGS OF "WET-FLEX"

The "wet-flex" experiments (purposefully flooded ponds) have been unsuccessful for the following reasons:

-- The experiments have not demonstrated that permanent flooding will result in a timely clean-up, because selenium concentrations in food chain organisms are still too high and may have reached a plateau.

-- The flooded ponds attract wildlife to the contaminated food chain.

-- Artificially flooding the southern ponds creates a groundwater mound that exacerbates the problems with ephemeral pools in the northern ponds.

-- The reducing conditions in the flooded pond sediments have caused a slow downward migration of selenium, so that excavation of the surface sediments will be less effective.

In short, "wet-flex" experiments have not demonstrated an effective clean-up method for the southern ponds, and in fact will result in continued damage to wildlife.

The contamination problem in the northern ponds was largely ignored in the original "wet-flex" and "immobilization" proposals, which included only surface discing and monitoring of the ponds. The recent data, which undeniably demonstrate severe contamination in the ephemeral pools of the northern ponds, further substantiate the inadequacy of the "wet-flex" and "immobilization" plans.

OTHER POTENTIAL CLEAN-UP METHODS

Just as we might expect from the Second Law of Thermodynamics, the selenium in the reservoir is slowly dissipating. Methods to artificially enhance the rates of these dissipation processes have been studied, but none has been fully evaluated in the field. For example, enhanced microbial volatilization may prove useful for depleting the selenium inventory which continues to rise to the surface via capillary action; the time and money required to decrease the selenium to safe levels are unknown. (Among the major expenses will be the irrigation required to maintain the soil moisture at field capacity.) Further, like excavation, this volatilization process

"treats" only the selenium in the surface layer; if used without grading (or other measures to control rising groundwater), the volatilization process will not solve the ephemeral pool problem in the short term. Combined with other cleanup and management measures, such as the Onsite Disposal Plan and grading, the microbial volatilization process may be useful for continuously depleting the additional selenium which rises into the surface soils via capillary action.

CONDITIONS FOLLOWING ONSITE DISPOSAL EXCAVATIONS

The Bureau has suggested that more damage to wildlife might occur following the excavations required by the Onsite Disposal Plan than would occur if no cleanup were attempted, due to the formation of additional ephemeral pools. In light of the clear risks to wildlife of the "wait-and-see" approach, the facts upon which the Bureau's assertion are based do not justify abandoning the plan. First, the Bureau's evidence does not demonstrate that conditions would be significantly worse following excavation. Second, the Bureau has assumed that no follow-up measures will be taken, such as leveling the "pockets" formed by excavation in order to minimize pooling from rising groundwater.

Assuming that the site can be graded following excavation, the question remains, "how much water will rise to the surface and what will the selenium concentration be?" Based upon the evidence currently available, it is impossible confidently to predict either the extent of surface flooding due to rising groundwater under natural conditions, or the concentration of selenium in areas which become flooded. Therefore, the evidence does not justify abandoning the on-site disposal plan.

The difficulty in predicting the extent of surface flooding under natural conditions arises because most of the hydrological data has been obtained when the reservoir was artificially flooded. Dr. Williams has attempted to reconstruct groundwater levels prior to artificial flooding using well logs from 1970-71 and 1971-72 (see Volume 1, Section C, Declaration 4 in the Bureau's pre-hearing submission). Using this data, he has calculated an increase in the surface area of ephemeral pools after excavation from 444 acres to 634 acres. This is probably the best estimate of its kind that can be made under the circumstances, but is not a strong basis upon which to make a decision not to excavate. The estimate actually only tells us how much of the land surface to be excavated is less than six inches (the assumed excavation depth) above the maximum water table elevation, and is useful only if we assume that 1970-72 was a representative period. (In fact, we know little about the water management practices in the surrounding lands during this time). A more meaningful estimate would compare the land area which would be flooded after grading the site, and the length of time it would remain flooded, for both the pre- and post-excavation land elevations.

The question regarding the selenium concentration in flooded areas remains unanswered. Despite several experiments on scraped, excavated and unaltered test plots, no relationship has been determined between the concentration of selenium in the pore waters of the vadose zone and the resulting selenium concentration in surface water due exclusively to rising

groundwater and rainfall[1] (not due to groundwater movement caused by artificially flooding the ponds). The difficulty in establishing this relationship stems from a variety of factors, including the high spatial variability of pore water concentrations[2] and the difficulty in insuring that groundwater surfacing in test plots is the result of vertical flow and not subsurface lateral flow. At best, the test results are mixed.

The greatest technical drawback to the Onsite Disposal Plan appears to be its effect on reducing the volume of sediments in the reservoir, thereby lowering the land elevation. The significance of this elevation decrease is uncertain, particularly if the site is graded following excavation. In order to partly offset this disadvantage, the dike material should be graded into the site following excavation.

While the extent of surface water contamination following excavation remains unclear, there is one major benefit of excavating: reduce the selenium inventory which must be managed. With the exception of the Onsite Disposal Plan, all of the options currently being considered for ultimate clean-up rely on slowly diluting the selenium into the air or water; having less selenium to dilute may make this dispersion process finish faster.

RELATIVE COSTS

Based upon the current record, it is difficult to construct a fair cost comparison between the Onsite Disposal Plan (with appropriate follow-up

[1] For this reason, the cost estimates which are based upon excavation of all soils with more than 5 ug/l selenium in the pore water are irrelevant.

[2] For example, see Figure 7b in Lawrence Berkeley Laboratory's Progress Report #7, Volume 5, Section H in the Bureau's pre-hearing submission.

measures such as grading) and the proposed alternate plan. However, it seems reasonable to assume for the sake of comparison that post-excavation measures will not be more expensive than alternative (without excavation) cleanup measures. In this case the cost differential would be closer to $20 million than $100 million. Improved estimates could make the cost differential even smaller.

It is interesting to note that the Bureau has cited the limited lifetime of the disposal facility (20-50 years) as a major reason not to implement the Onsite Disposal Plan; presumably, the cost of rehabilitating the landfill is the major concern. However, if two of the Bureau's prime technical assumptions are correct--that selenium will not be mobile enough in the vadose zone to significantly pollute the groundwater, and that selenium-contaminated "upland" areas may not pose a risk to wildlife--then "rehabilitation" of the landfill to render it harmless to the environment may be quite inexpensive.

CONCLUSIONS

The Board should reject the alternative plan recommended by the Bureau. The major problem that has been identified by recent studies is that of stored selenium in the pore water of the vadose zone. The Bureau's plan does not solve this problem. Nor is there a convincing argument that the problem will be solved faster, better, or more cheaply if the Onsite Disposal Plan is not implemented.

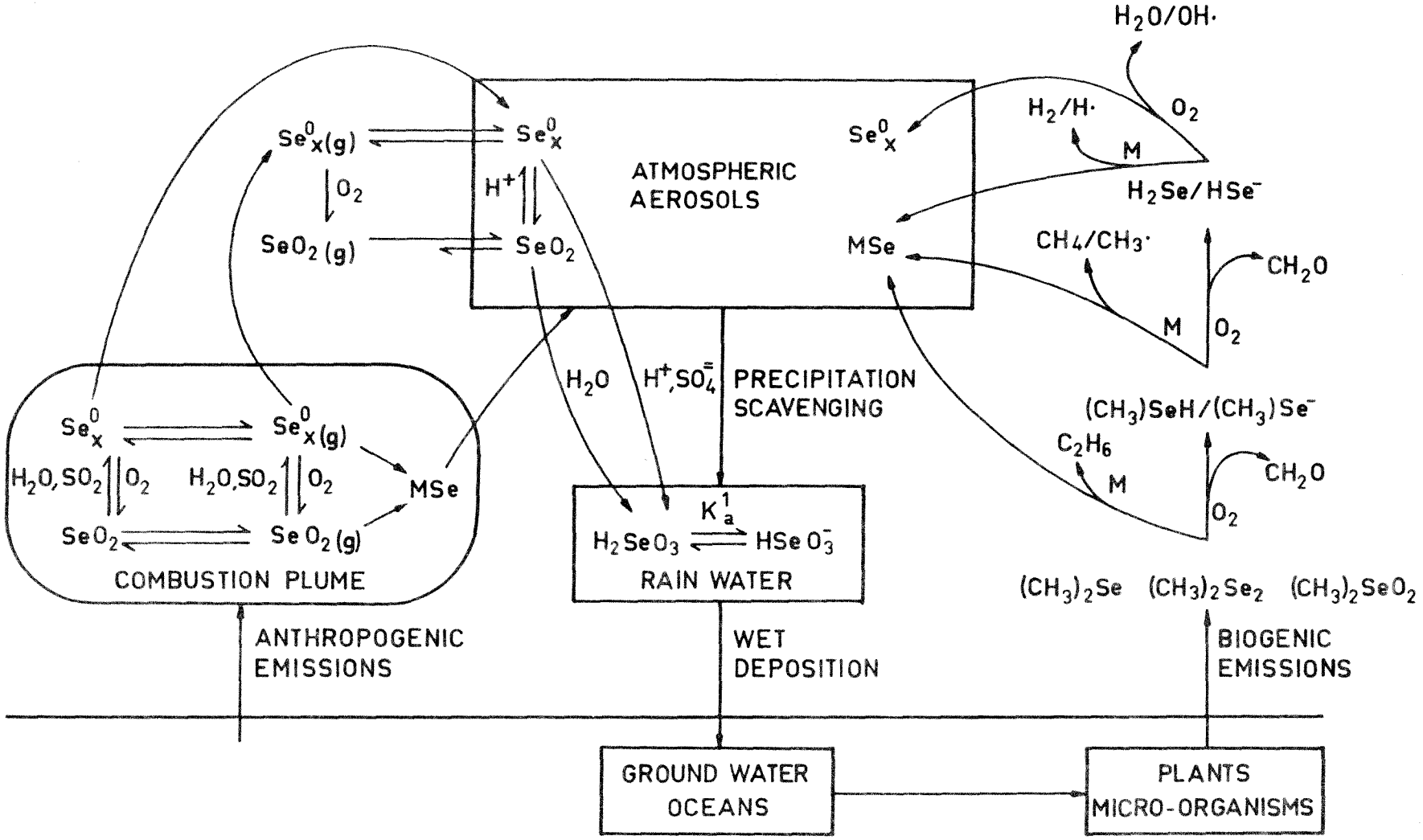
The additional information now on the record suggests that post-excavation management should be designed to minimize the formation of ephemeral pools, and to make the management of both vegetation and wildlife in the pools as effective as possible.

Dr. Ulrich Karlson
University of California
Riverside

SELENIUM CONTAMINATION
HIGH-RISK SITES

Kesterson National Wildlife Refuge, near Los Banos, California
Ouray National Wildlife Refuge, Green River, Utah
Kendrick Irrigation Project, Wyoming
Kern National Wildlife Refuge, Tulare Lake Basin, north of Bakersfield, California
Yuma Valley and Imperial National Wildlife Refuge, Arizona
Salton Sea National Wildlife Refuge, California
Imperial Valley, California
Benton Lake National Wildlife Refuge, Montana
Bowdoin National Wildlife Refuge, Montana
Fallon and Stillwater National Wildlife Refuge, Nevada
Poison Canyon, New Mexico
Angostura, South Dakota
Belle Fourche, South Dakota

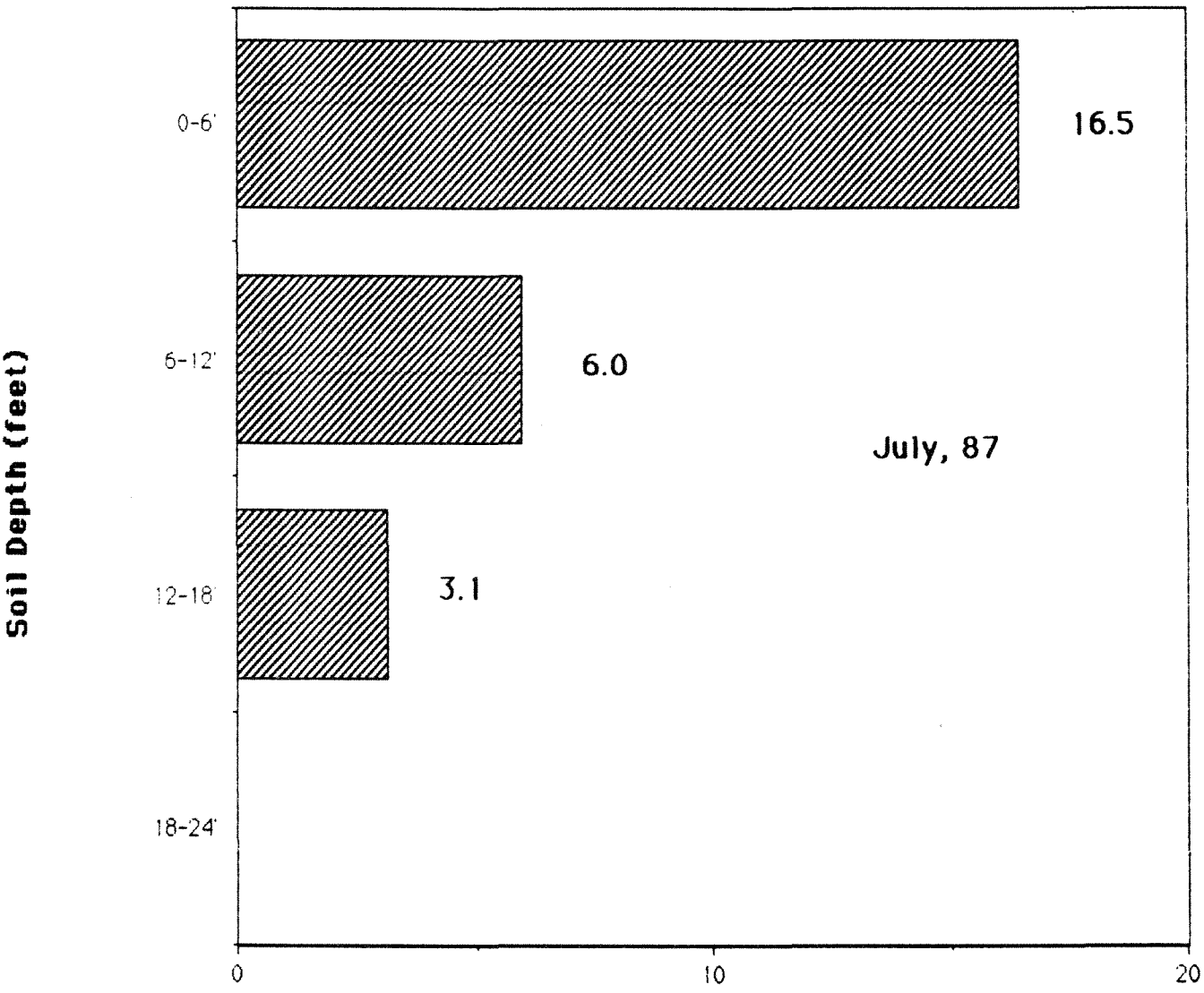
Lower Colorado River ?
Power Plants vs. Agricultural Drains

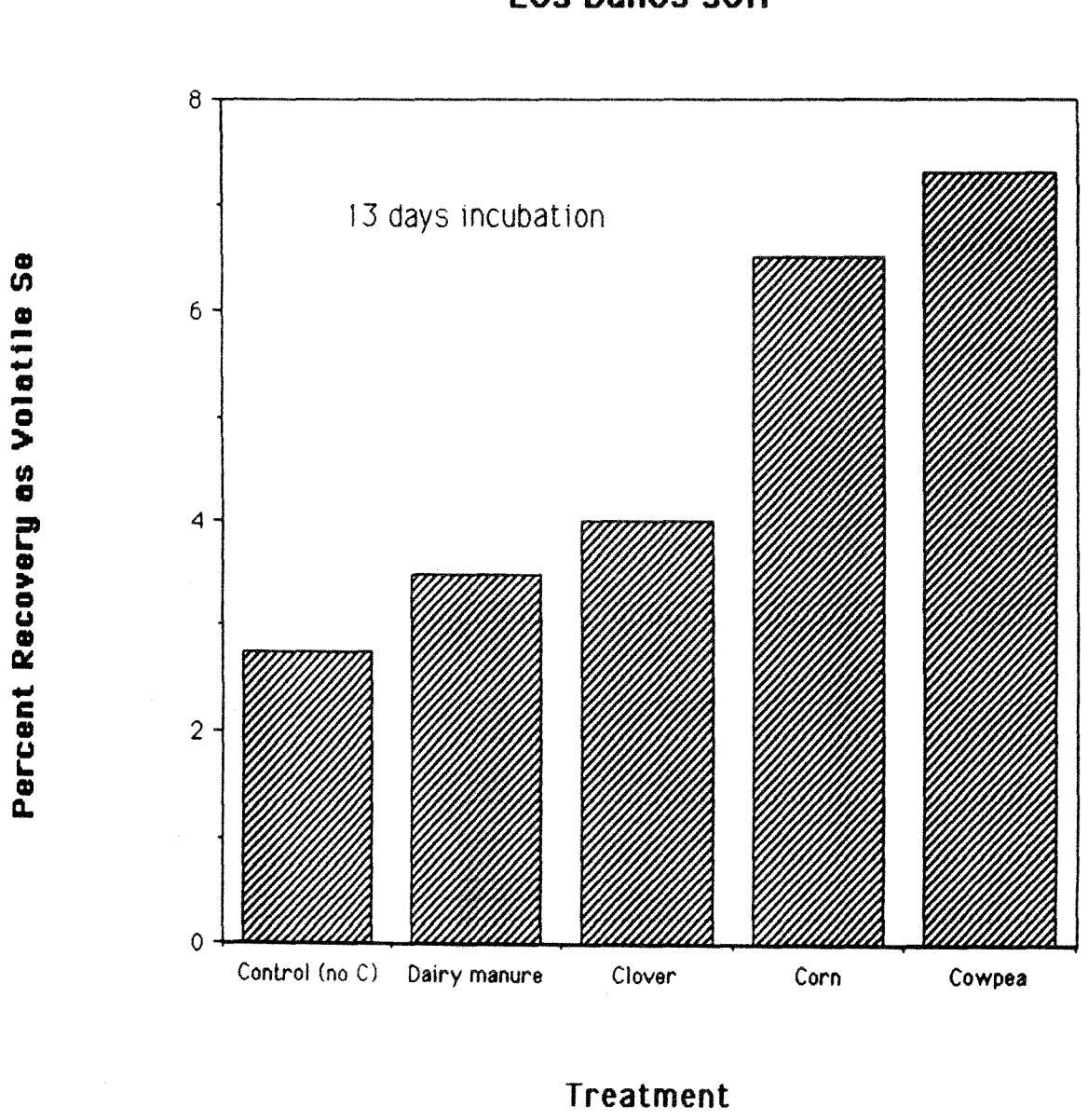

$H_2O/OH\cdot$
$H_2/H\cdot$
O_2
M
H_2Se/HSe^-
Se^0_x
$Se^0_x(g)$
O_2
$SeO_2(g)$
H^+
SeO_2
ATMOSPHERIC AEROSOLS
MSe
$CH_4/CH_3\cdot$
CH_2O
M
O_2
H_2O
$H^+, SO_4^=$
PRECIPITATION SCAVENGING
$(CH_3)SeH/(CH_3)Se^-$
C_2H_6
M
CH_2O
O_2
H_2O, SO_2
O_2
H_2O, SO_2
O_2
MSe
SeO_2
$SeO_2(g)$
COMBUSTION PLUME
K^1_a
$H_2SeO_3 \rightleftharpoons HSeO_3^-$
RAIN WATER
$(CH_3)_2Se$ $(CH_3)_2Se_2$ $(CH_3)_2SeO_2$
ANTHROPOGENIC EMISSIONS
WET DEPOSITION
BIOGENIC EMISSIONS
GROUND WATER OCEANS
PLANTS MICRO-ORGANISMS

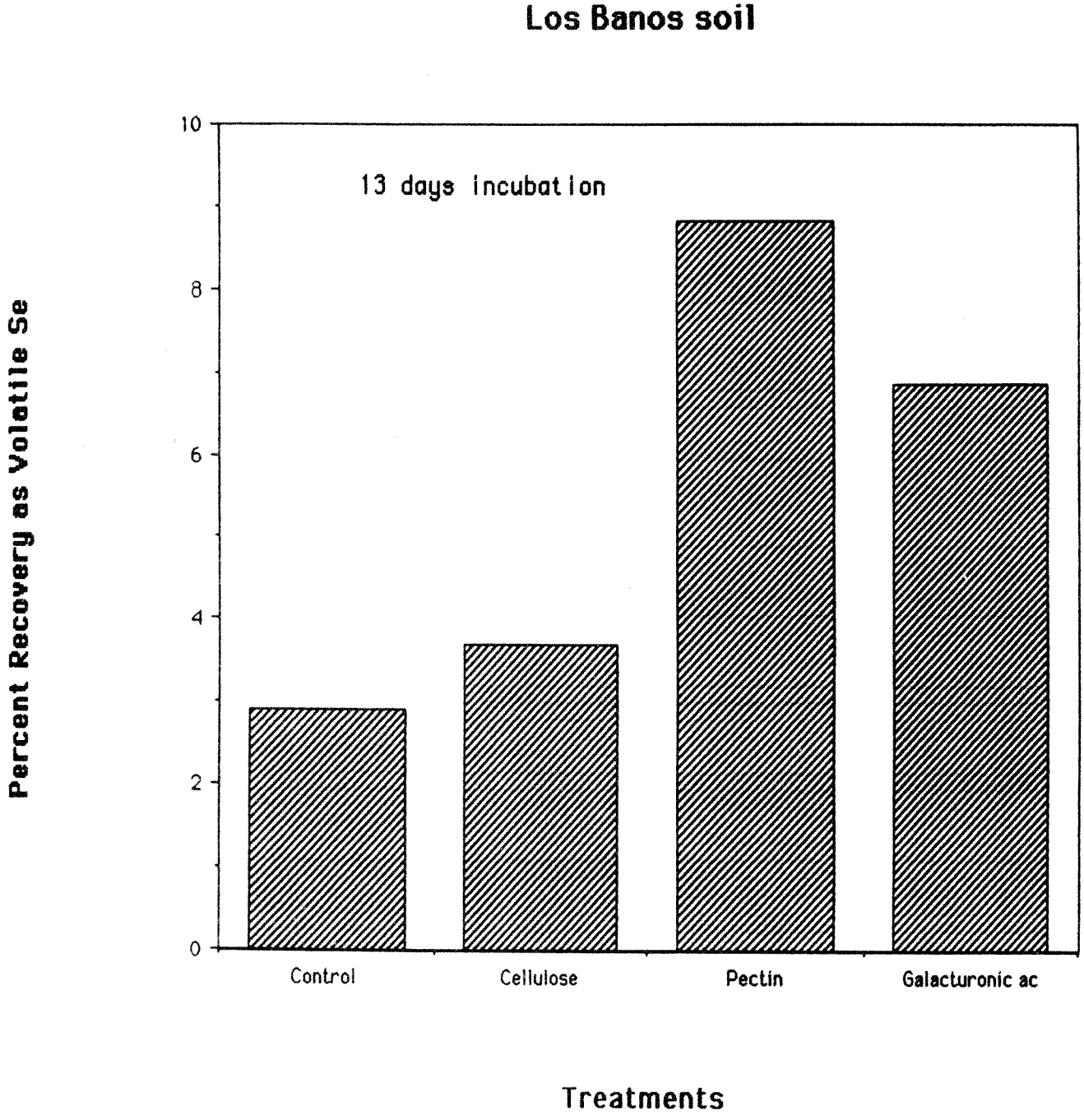
Atmospheric Emissions of Selenium between 30°N and 90°N*	
Source:	**Mg y^{-1}**
Mining and Industry	1800
Soil	1300
Plants	1400 - 8100
Volcanoes	≤100

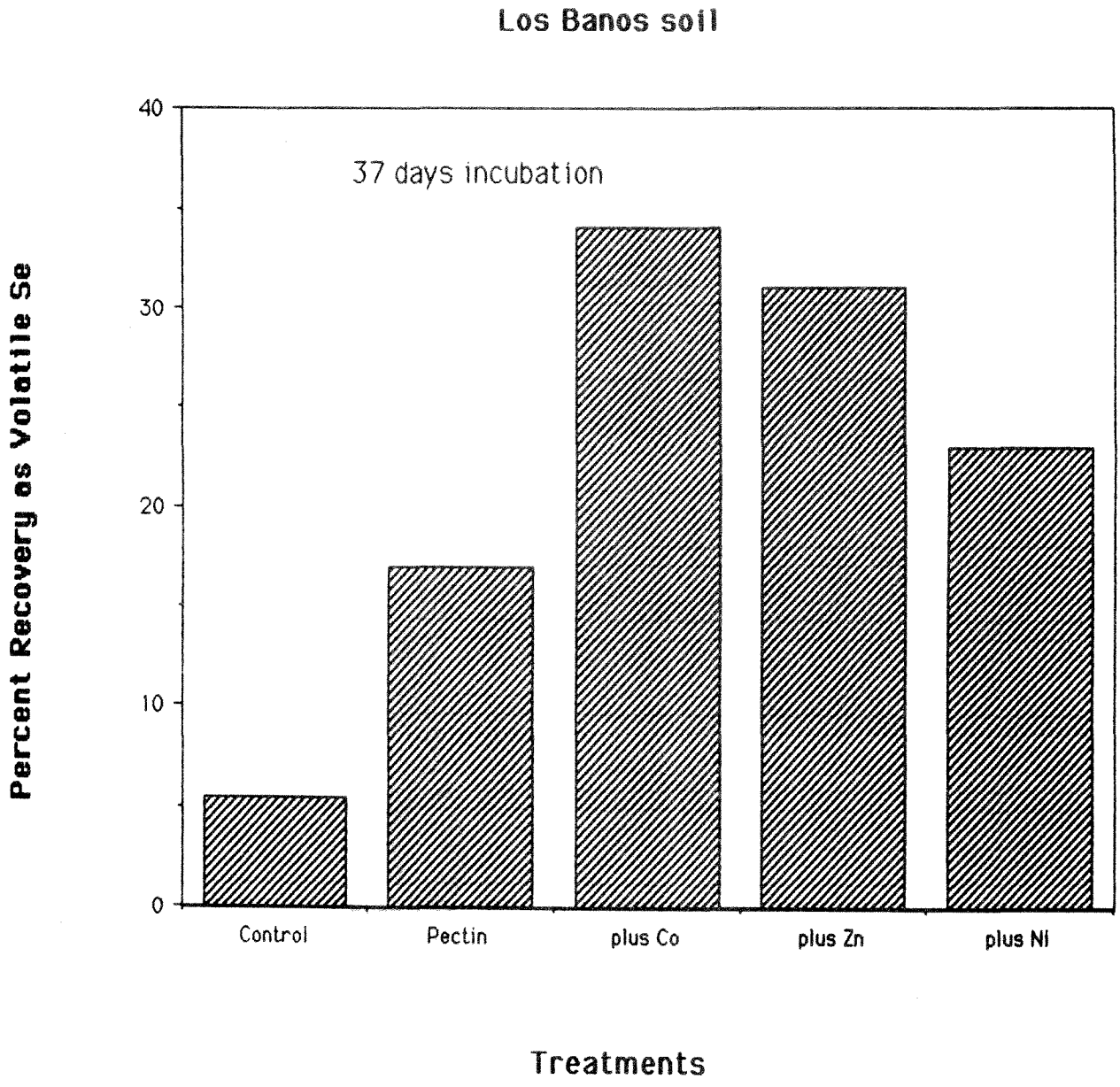
*according to H.B. Ross, 1984

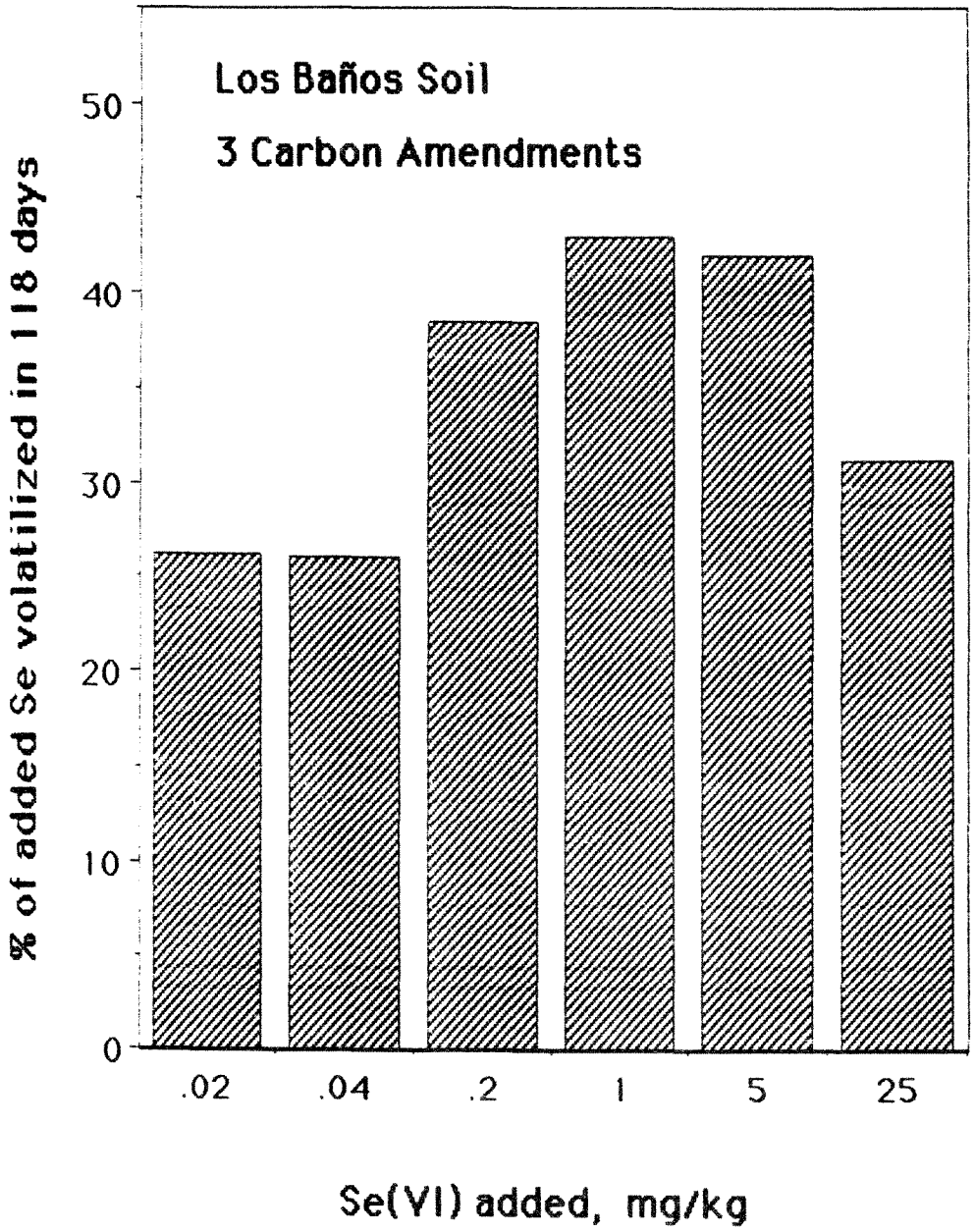
PLOT 53


Soil Depth (feet)
0-6'
6-12'
12-18'
18-24'
16.5
6.0
3.1
July, 87
0
10
20
Total Se (mg/kg)


Los Banos soil
13 days incubation
Percent Recovery as Volatile Se
0
2
4
6
8
Control (no C)
Dairy manure
Clover
Corn
Cowpea
Treatment


Los Banos soil
13 days incubation
Percent Recovery as Volatile Se
10
8
6
4
2
0
Control
Cellulose
Pectin
Galacturonic ac
Treatments


Los Banos soil
37 days incubation
Percent Recovery as Volatile Se
40
30
20
10
0
Control
Pectin
plus Co
plus Zn
plus Ni
Treatments


Los Baños Soil
3 Carbon Amendments
% of added Se volatilized in 118 days
50
40
30
20
10
0
.02
.04
.2
1
5
25
Se(VI) added, mg/kg

APPROXIMATE PECTIN CONTENT OF VARIOUS PLANT MATERIALS

Plant Material	Total Pectic Substance as % of Dry Material
Potatoes	2.5
Carrots	10.0
Horseradish	15.0
Tomatoes	3.0
Apples	4-7
Apple pomace	15-20
Sunflower heads (without seeds)	25
Sugar beet pulp	15-20
Citrus peel (albedo)	30-35

Source: Neukom (1967).

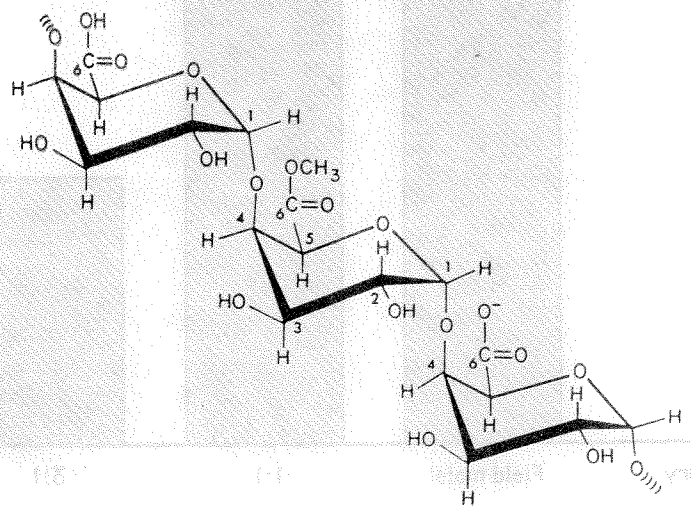
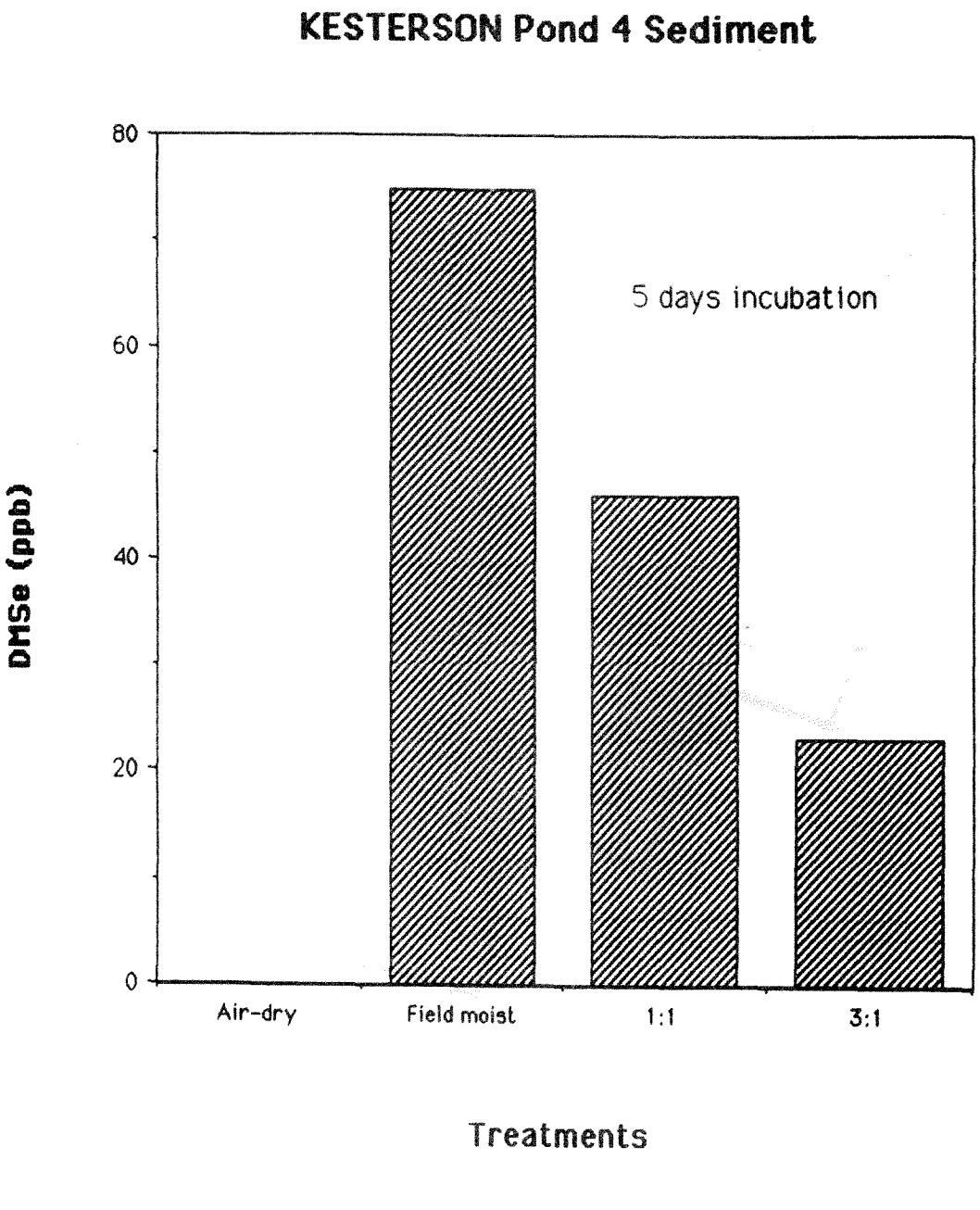
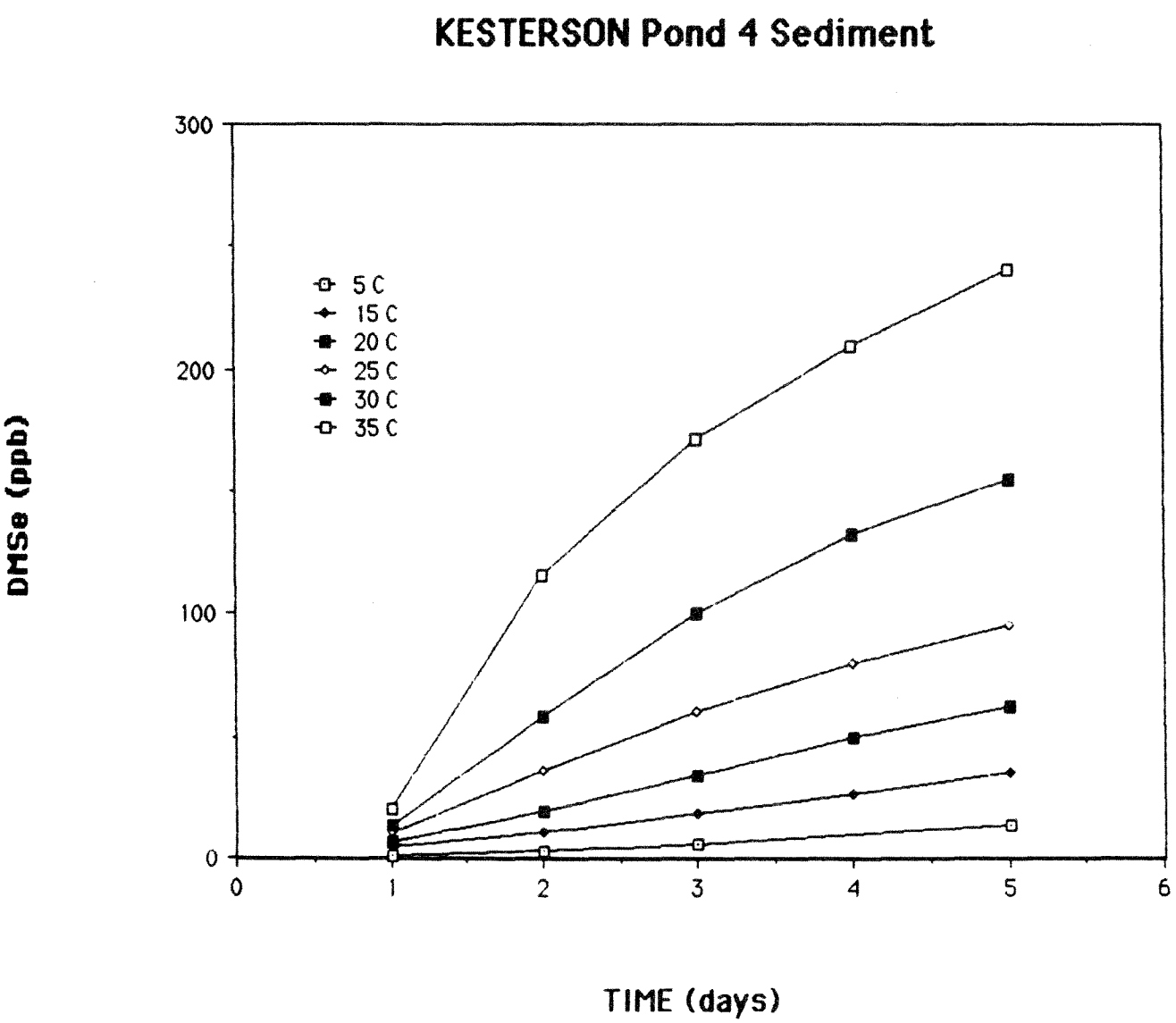


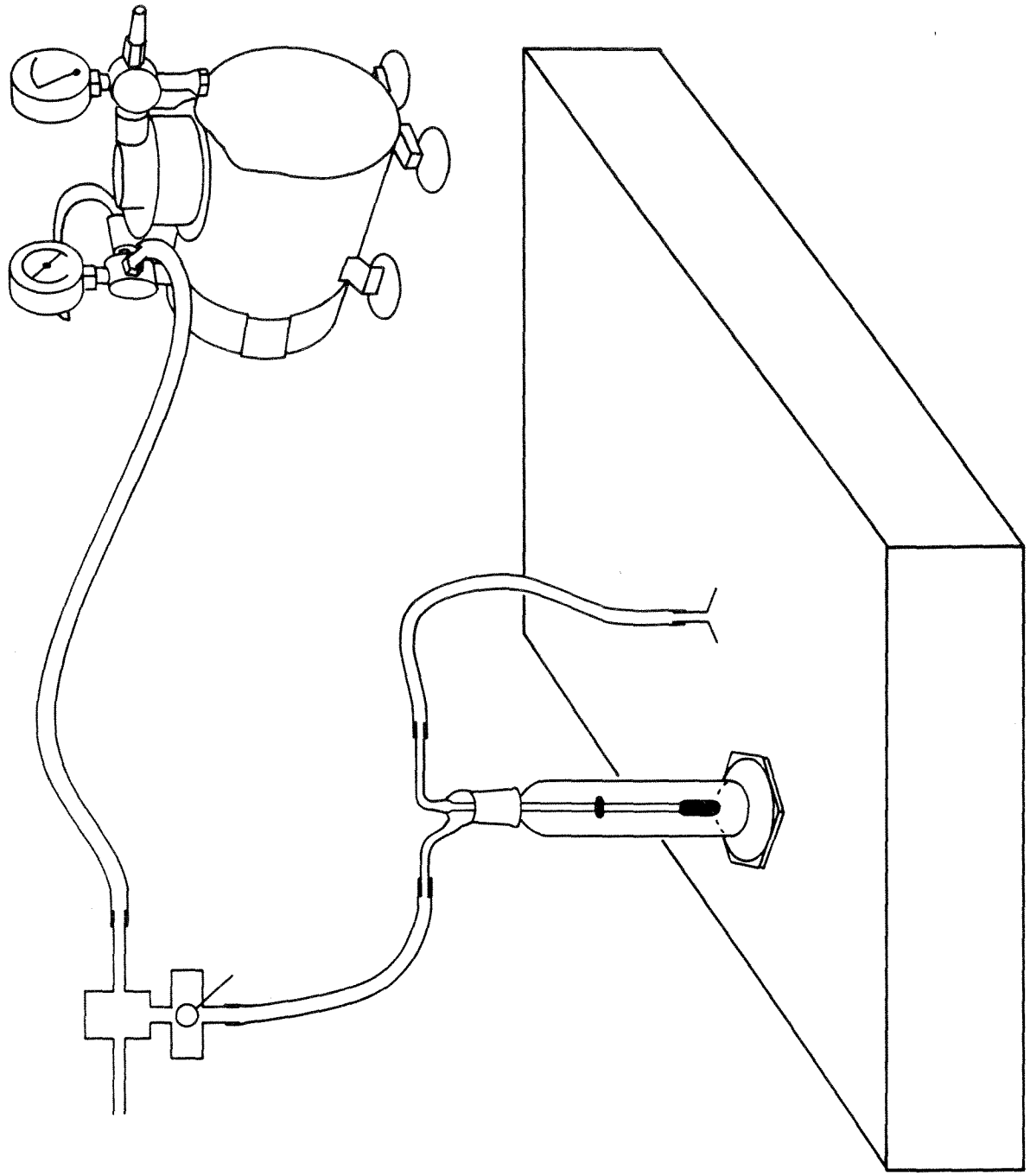
Fig. 1. Representation of a portion of the galacturonan chain.

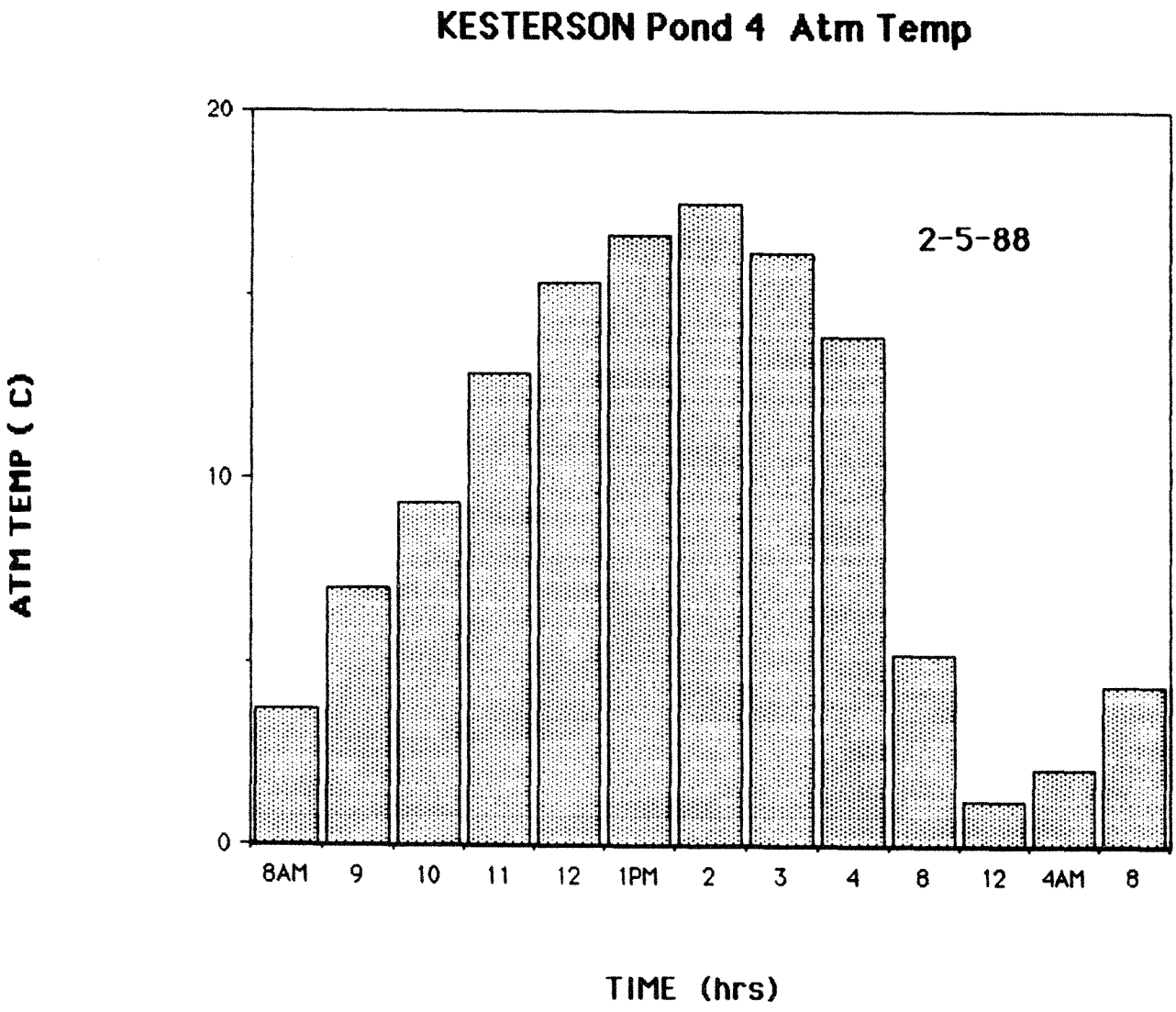

KESTERSON Pond 4 Sediment
80
60
40
20
0
DMSe (ppb)
5 days incubation
Air-dry
Field moist
1:1
3:1
Treatments

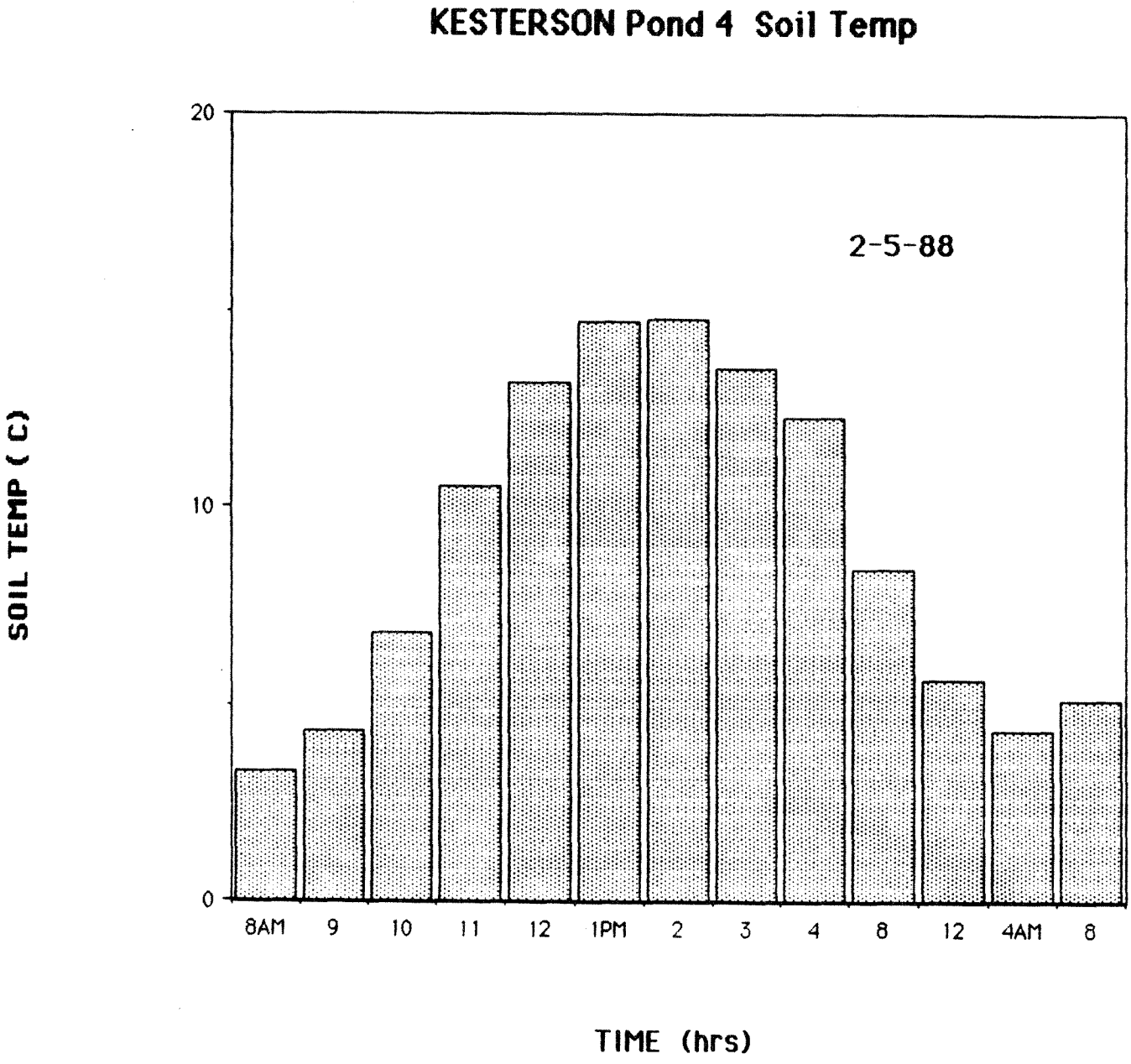

KESTERSON Pond 4 Sediment
DMSe (ppb)
300
200
100
0
0
1
2
3
4
5
6
5 C
15 C
20 C
25 C
30 C
35 C
TIME (days)

TREATMENTS

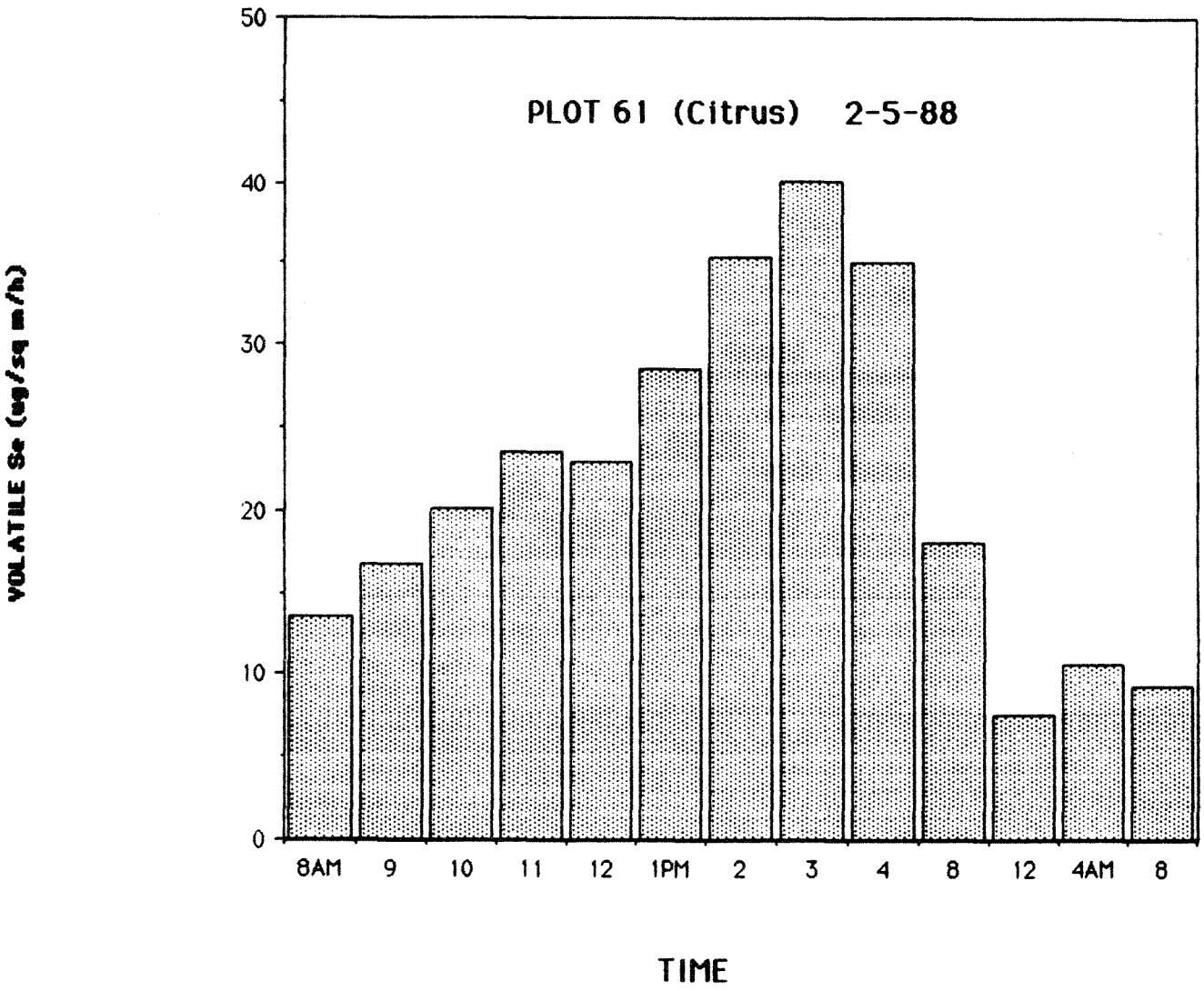
C AMENDMENTS	FERTILIZERS
Citrus Peel	$ZnSO_4$
Cattle Manure	$(NH_4)_2SO_4$
Straw	$(NH_4)_2NO_3$
Grape Pulp	
Molasses	
Tullies (Natural Vegetation)	



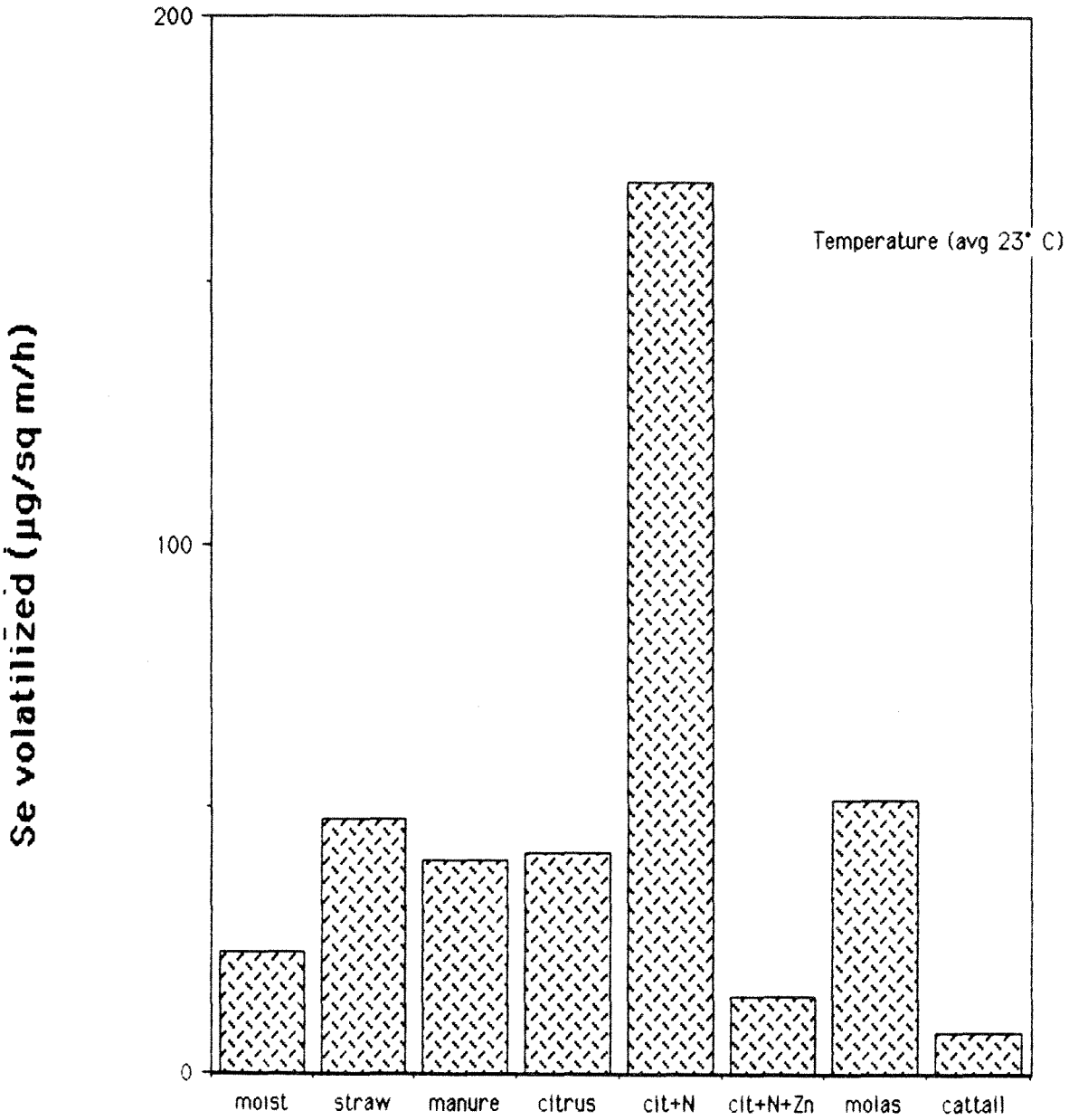

KESTERSON Pond 4 Atm Temp
2-5-88
ATM TEMP (C)
20
10
0
8AM
9
10
11
12
1PM
2
3
4
8
12
4AM
8
TIME (hrs)


KESTERSON Pond 4 Soil Temp
2-5-88
SOIL TEMP (C)
20
10
0
8AM
9
10
11
12
1PM
2
3
4
8
12
4AM
8
TIME (hrs)

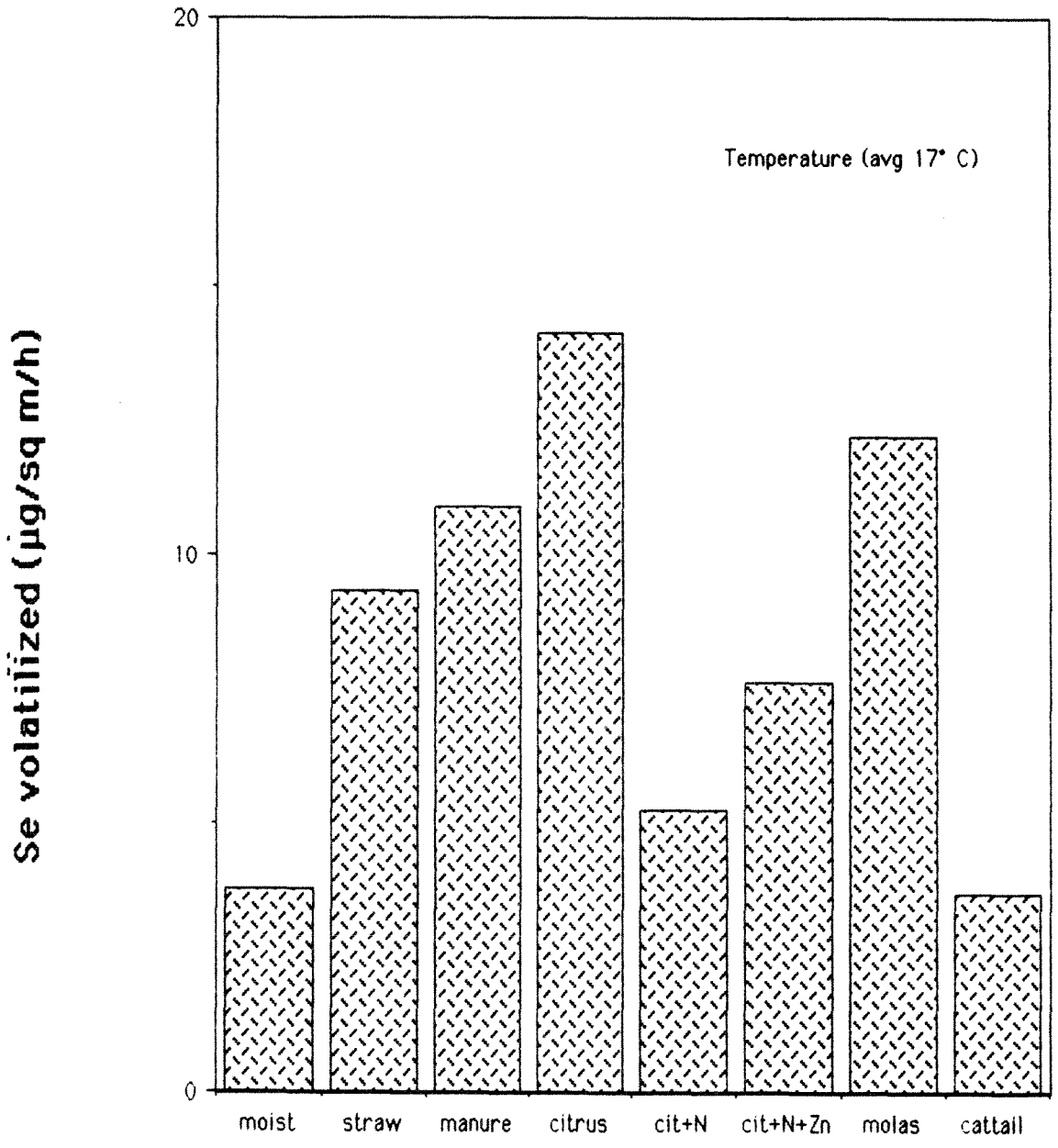
KESTERSON Pond 4 Diurnal Sampling



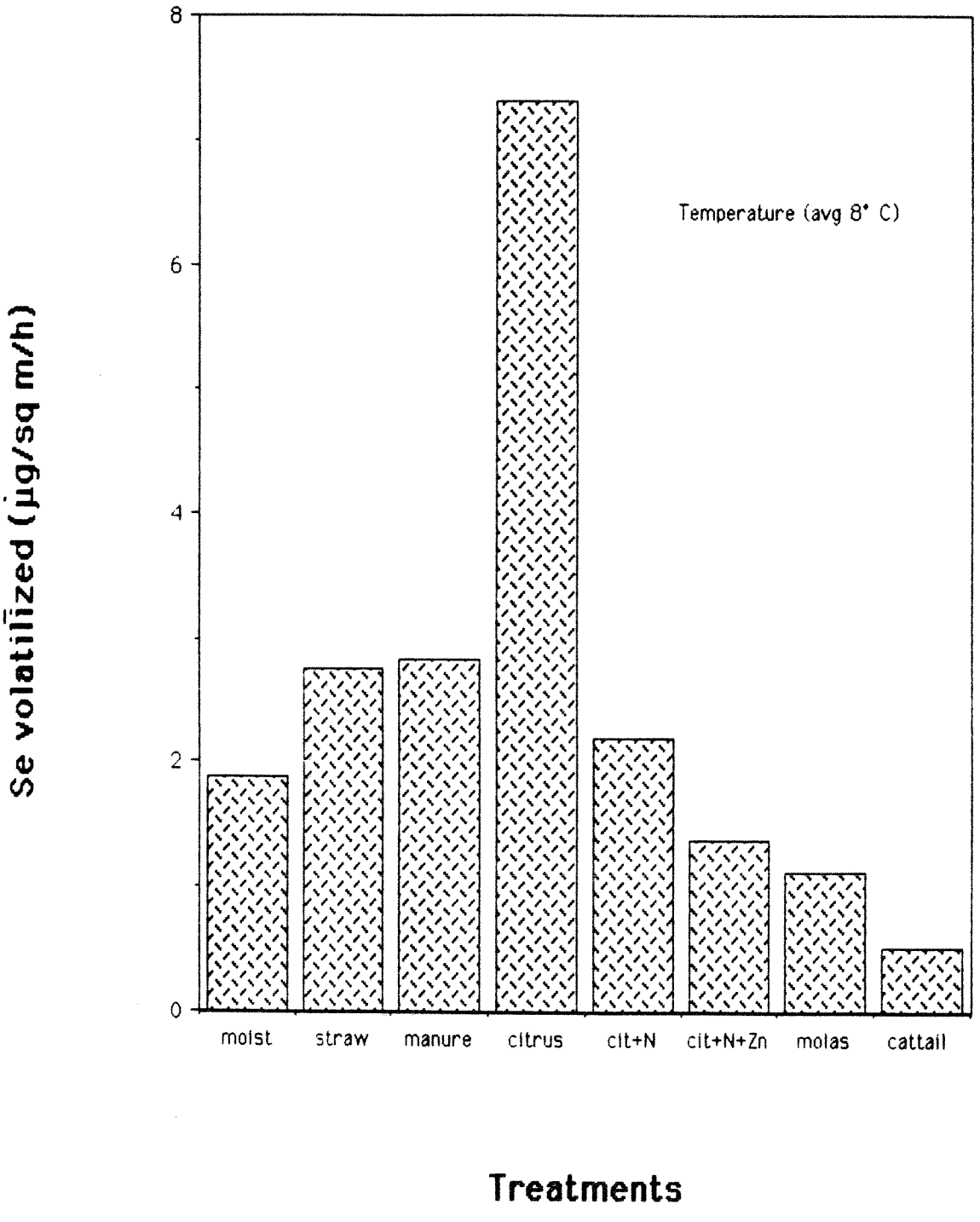
POND 4 - OCTOBER



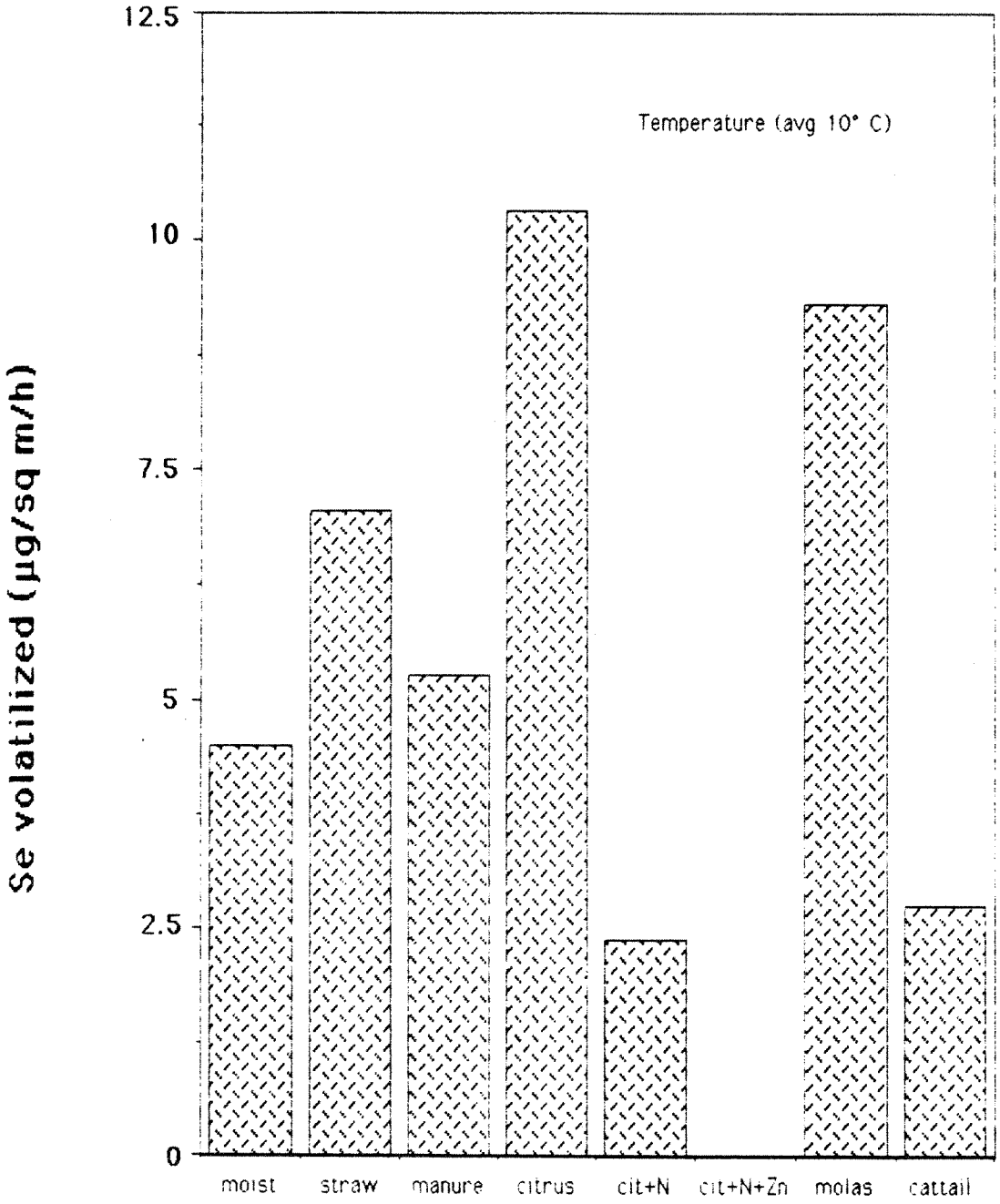
POND 4 - NOVEMBER



POND 4 - DECEMBER



POND 4 - JANUARY



The Frankenberger-Karlson Process